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Spokane County Comprehensive Wastewater Management Plan. Draft Environmental Impact Statement

(U.S.) Environmental Protection Agency
Seattle, WA

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16. ABSTRACT

In 1979 Spokane County initiated a comprehensive wastewater management plan to identify ways to eliminate on-site waste disposal facilities in the highly urbanized unicorporated areas that surround the city of Spokane. The draft plan recommends a phased program of constructing trunk interceptors, stroage basins, and collection systems in the county. In this draft EIS, EPA has examined the environmental consequences of both phases of Spokane County's comprehensive wastewater management plan.

17. KEY WORDS AND DOCUMENT ANALYSIS

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ERRATA

OMISSIONS

Page	
50&51	Tables 2-5 and 2-6, footnote 1 should be modified to read as follows: effluent concentration data from Collins, Ryder and Watkins (pers. comm.); recent communications suggest that the total phosphorus concentration of 1.4 mg/l (P) is not indicative of current effluent quality being achieved at the Spokane wastewater treatment plant (Yake, telephone conversation, January 20, 1981; Soltero, telephone conversation, January 21, 1981).
50&51	Tables 2-5 and 2-6, add footnote 4 as follows: chlorine concentration based on effluent quality data received from City of Spokane wastewater treatment plant personnel. Yake (telephone conversation, January 23, 1981) indicates that present concentrations range from 0.7-1.2 mg/l.
75	Paragraph entitled Toxic Substances - add the following material to the end of the first sentence in the paragraph: . . . at mean flow. At Q_{7-10} flows, however, resultant river concentrations of un-ionized ammonia and chlorine may exceed EPA criteria for protection of freshwater life (U. S. EPA 1976). Based on existing data, un-ionized ammonia concentrations could reach 0.15 mg/l during certain periods of the year, whereas chlorine concentrations could reach 0.05 mg/l. The chlorine concentration increase could be much higher if projected effluent concentrations exceed the 0.5 mg/l estimate received from City of Spokane treatment plant personnel.
	Paragraph 2, add the following material to the end of the first sentence in the paragraph: . . . at mean flow. At Q_{7-10} flows, existing data indicate that un-ionized ammonia concentrations in the

OMISSIONS

Page	
77, Cont'd.	river could reach 0.17 mg/l in 1992 and 0.23 mg/l in 2002. These concentrations are considerably higher than EPA recommended criteria (U. S. EPA 1976). Chlorine concentrations immediately below the outfall site could also exceed recommended criteria, especially if effluent concentrations ever exceed 0.5 mg/l.

CLARIFICATION

42-56	Projected effluent quality data used in the water quality analysis of this EIS (pages 42-56) were supplied by the facilities planners. Discussions (Yake, telephone conversation, January 20, 1981) since printing of the Draft EIS indicate the effluent phosphorus concentration of 1.4 mg/l (P) may be in error. It is not clear whether this number is to represent total phosphorus (P) or total phosphate (PO_4). It was shown in information supplied by Collins, Ryder and Watkins (pers. comm.) to represent total phosphorus (P). If this is in error, present and projected phosphorus loading data included in the 4th paragraph on page 49, Tables 2-5 and 2-6 (pages 50 and 51), paragraphs 1 and 5 of page 52, and paragraph 2 of page 53 are excessive.

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United States
Environmental Protection
Agency

Region 10
1200 6th Avenue
Seattle WA 98101

PB81-165441

Water
February 1981
EPA-10-WA-Spokane-WWTW-81

Environmental Impact Statement

Draft

Spokane County Comprehensive Wastewater Management Plan

DRAFT ENVIRONMENTAL IMPACT STATEMENT

COMPREHENSIVE WASTEWATER MANAGEMENT PLAN
SPOKANE COUNTY, WASHINGTON

Prepared by

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January 8, 1981
Date

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Executive Summary

EXECUTIVE SUMMARY

(X) Draft Environmental Impact Statement

( ) Final Environmental Impact Statement

Type of Action: Administrative

Purpose and Need for Action

The City of Spokane, Washington is located on the western fringe of a glacial outwash plain that covers more than 350 square miles in northern Idaho and eastern Washington (Figure 1). This plain is underlain by a large body of high quality water known as the Spokane Valley-Rathdrum Prairie Aquifer. For years this aquifer has been the primary source of drinking water for residents of the area.

The populations overlying and tapping this water source have increased rapidly in the last few years. Over 340,000 persons are now supplied water by the aquifer. The coarse nature of the outwash materials and the increasing human activity over the aquifer have created concerns for the long-term integrity of its water quality. Spokane County, Washington and the Panhandle Area Council of northern Idaho recently analyzed the aquifer water quality situation with the aid of federal grants from EPA. The studies concluded that the on-site wastewater disposal practices being used in densely populated areas over the aquifer were contributing to a general deterioration in groundwater quality. As a result, numerous recommendations have been made for actions that would lessen this threat to the area's drinking water supply.

In 1979 Spokane County initiated a Comprehensive Wastewater Management Plan (CWMP*) to identify ways to eliminate on-site waste disposal facilities in the highly urbanized unincorporated areas that surround the City of Spokane. EPA provided grant funds made available through the Clean Water Act to help with this planning. The draft CWMP was recently completed; it recommends a phased program of constructing trunk interceptors, storage basins and collection systems in the County areas to transfer wastewater off of the aquifer and into the City's central wastewater collection and treatment system.

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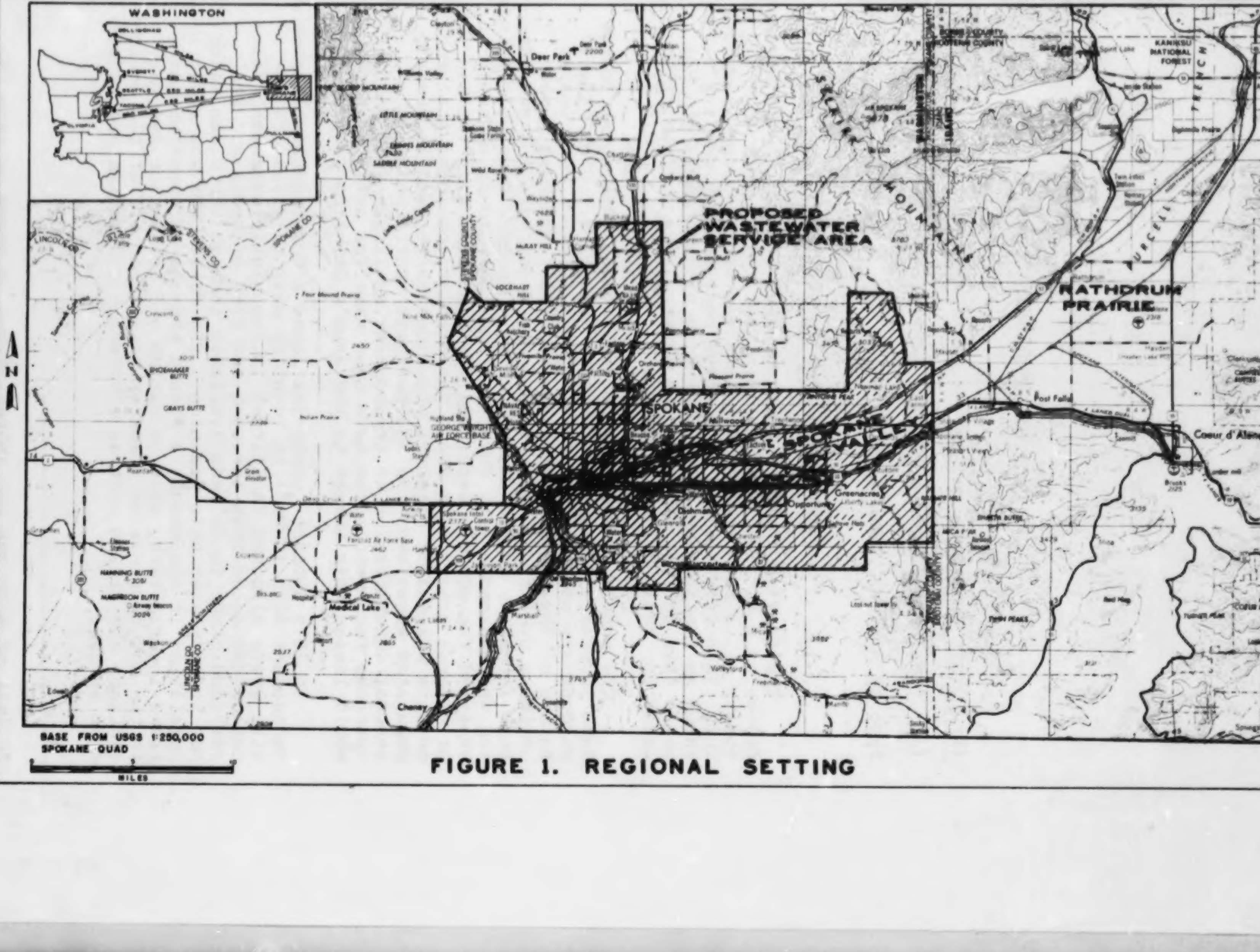
*A list of acronyms and abbreviations is found on page 197.



BASE FROM USGS 1:250,000
SPOKANE QUAD

MILES

FIGURE 1. REGIONAL SETTING

The first phase project would provide interceptor facilities to those portions of North Spokane and Spokane Valley that are immediately adjacent to the City. EPA's role in this first phase is currently limited to considering grant assistance to the County for the North Spokane interceptor. In order to make an informed decision on the County funding request, however, EPA has looked at the environmental consequences of both Phase I and Phase II of the CWMP in this EIS. The EIS has been prepared to satisfy the environmental review requirements of the National Environmental Policy Act (NEPA). Spokane County intends to use the EIS to also satisfy Washington State Environmental Policy Act (SEPA) review requirements.

Project Alternatives and Impacts

Spokane County and its engineering consultants have developed data on six alternative wastewater systems, including the system they are proposing. The EIS has analyzed all six of these "action" alternatives; in addition, the impacts of taking "no action" have been identified as required by federal regulations (40 CFR, Part 6). Each of these alternatives and its more important environmental impacts are summarized below.

No Action

Under the no action option, persons in the CWMP's General Sewer Service Area (GSSA) (Figure 2) that now rely on small community or individual on-site wastewater disposal facilities would continue to use them. The waste discharges would continue to occur over the Spokane Valley Aquifer, contrary to recommendations in the County 208 water quality management plan. This poses a continuing public health threat to residents of the Spokane area that draw their drinking water supplies from the aquifer, because the on-site waste disposal practices are degrading the quality of the aquifer. Without some new local growth control mechanisms, the numbers of persons disposing of wastes over the aquifer would increase significantly in the next 20 years. Groundwater degradation could have an economic as well as public health impact in that alternative water supply sources might eventually have to be developed.

The domestic wastes discharged directly to the Spokane River would increase slightly in the next 20 years under "no action". Growth within the City of Spokane and the Liberty Lake Sewer District would add 7.9 million gallons per day (MGD) to surface water discharges over that time period. The Liberty Lake discharge could adversely affect

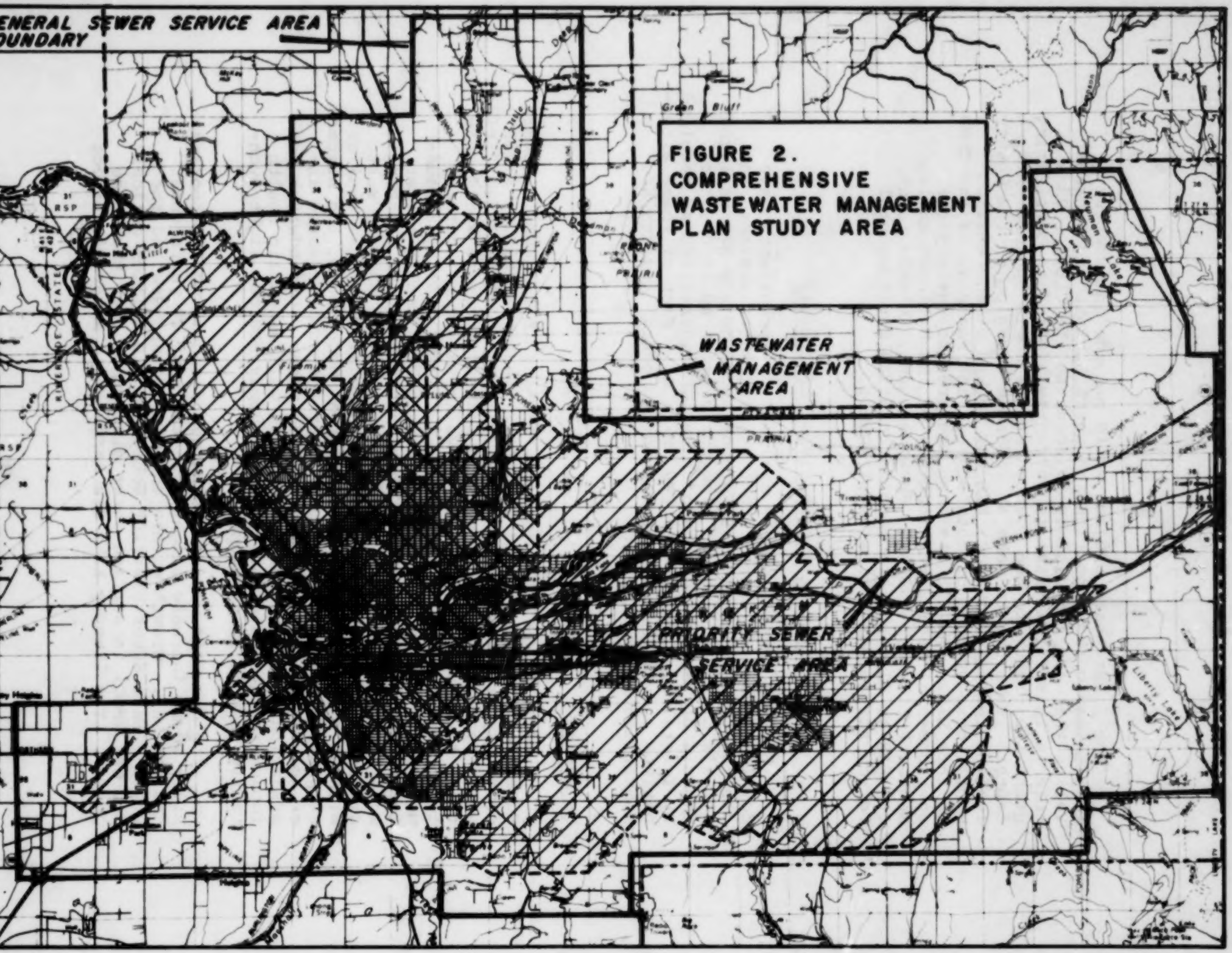


FIGURE 2.
COMPREHENSIVE
WASTEWATER MANAGEMENT
PLAN STUDY AREA

GENERAL SEWER SERVICE AREA BOUNDARY
WASTEWATER MANAGEMENT AREA
PRIORITY SEWER SERVICE AREA
Green Bluff
Newman Lake
Liberty Lake
PRAIRIE
RSP

downstream groundwater supplies because the discharge is located in a stretch of the river that recharges the underlying aquifer. No major surface water quality problems would likely result.

Spokane County and its residents would not face immediate major capital expenditures under the "no action" option. In exchange, however, they would face a continuing deterioration in the quality of their drinking water. This might eventually lead to a serious public health threat and a bigger economic burden in locating and tapping an alternative source of drinking water.

Alternative A

Wastewater from the major developed areas in North Spokane, Spokane Valley, Moran Prairie, and Indian Trail would be collected by interceptor and trunk sewers that would discharge into the City of Spokane sewer system. Flow equalization and storage basins would regulate the timing of these inputs to the City system to prevent increases in untreated combined sewer overflows that now occur, and improve treatment plant efficiency. These improvements would be made in Phase I of the plan's development. The anticipated Phase I service area is mapped as the Priority Sewer Service Area (PSSA) in Figure 2. As a second phase, flows from West Plains, Liberty Lake, Newman Lake, and expanded portions of Spokane Valley and North Spokane would be added to the collection system. All City and County flows would receive secondary treatment and phosphorus removal at the City plant and would be discharged to the Spokane River (Figure 3 contains a schematic diagram of all project alternatives). Alternative A is the County's preferred wastewater plan.

Sewering the urbanized County areas will reduce the major water quality threat in the area -- the threat of onsite waste disposal practices contaminating the underground drinking water supply. This is a significant beneficial impact.

In exchange, Alternative A would pose a long-term threat to water quality conditions in the Spokane River when considering the stretch below the City's present wastewater discharge. This is the result of concentrating the entire area's waste flows to a single discharge point downstream from the City. The water quality improvement being experienced in Long Lake could be reversed in the latter part of the project's 20-year planning time frame. Any reversal in Long Lake's water quality would result from increased nutrient loads in the river and would affect recreationists and lakeshore residents. The impact would be primarily

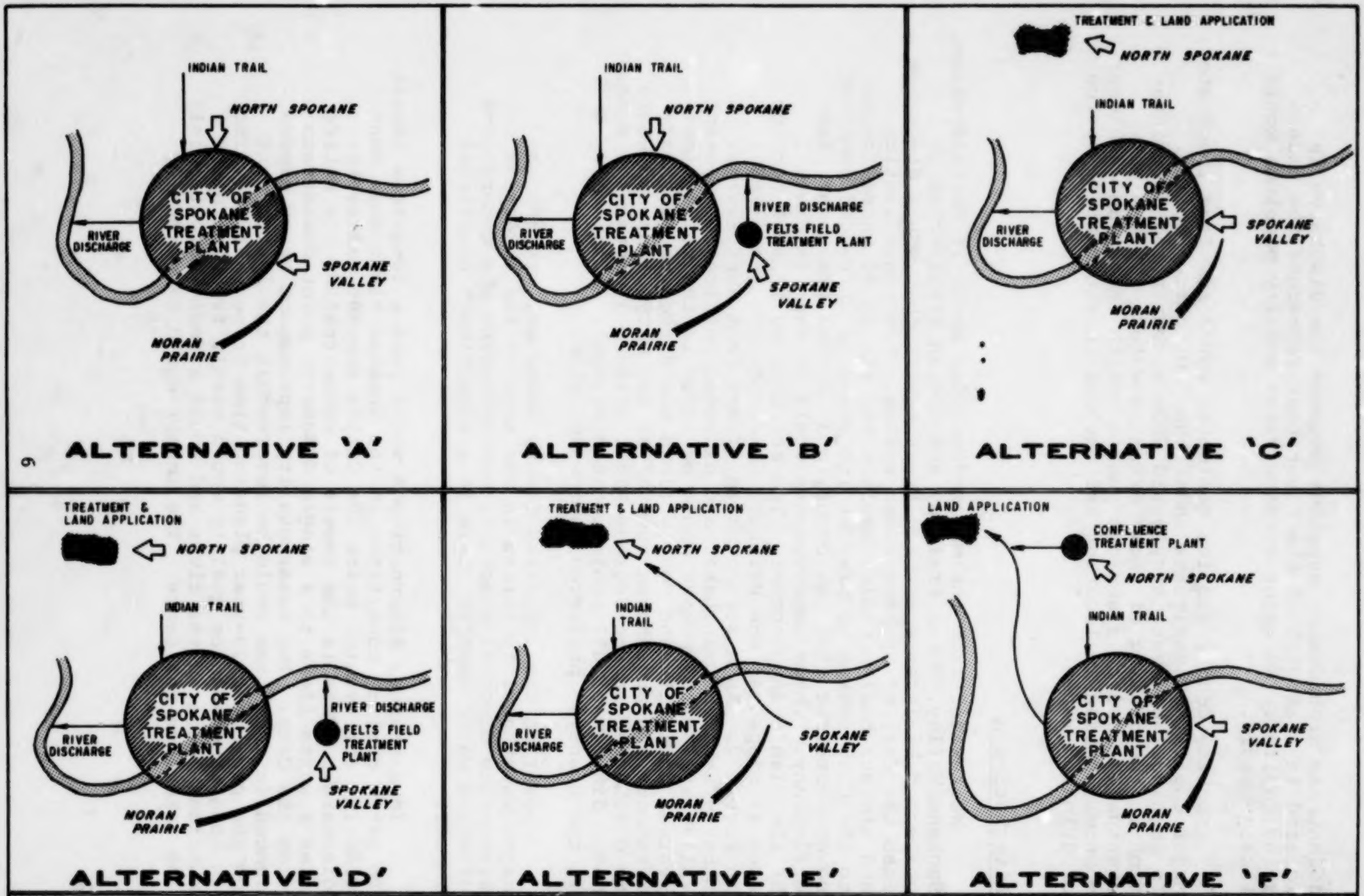


FIGURE 3. SCHEMATIC DIAGRAMS OF PROJECT ALTERNATIVES

aesthetic but might also have some economic ramifications for lakeside properties. Visible surface water quality deterioration from algal blooms would be primarily summer and fall phenomena. The present worth capital cost of Alternative A is $57,525,000.

Alternative B

Wastewater flows from the Spokane Valley (eventually including Liberty Lake and Newman Lake) and Moran Prairie would be conveyed to a new treatment plant near the east end of Felts Field where secondary treatment plus phosphorus removal would be provided. The wastewater would be discharged to the Spokane River at that location, upstream from the City of Spokane. North Spokane, West Plains and Indian Trail would be served by the City plant as described in Alternative A.

Alternative B would provide a similar protection to Spokane Valley Aquifer water quality as Alternative A. Persons using septic tanks over the aquifer would be sewered and connected to central wastewater treatment systems.

Alternative B lessens the surface water quality impacts of Alternative A below the City treatment plant by moving the combined Spokane Valley, Moran Prairie, Liberty Lake, and Newman Lake waste discharge just upstream of the City. In exchange, however, the new discharge would adversely affect popular river recreation areas downstream from Felts Field and could affect downstream groundwater supplies. Alternative B has a present worth capital cost $25,518,000 greater than Alternative A.

Alternative C

Wastewater from North Spokane would be concentrated at a site near the fish hatchery where a pump station would convey flows to the Rutter Parkway area. Secondary treatment and disposal by infiltration/percolation through the soil would be provided. All other County areas would be served by the City plant as described under Alternative A.

Alternative C provides the same groundwater quality benefits as Alternative A and at the same time reduces the overall surface discharge of wastewater by 4.7 MGD by 2002. This would lessen in-stream impacts to the river's beneficial uses both upstream and downstream of Spokane.

The land disposal of North Spokane's wastewater would remove 63 acres of open grassland in the Rutter Parkway area and would probably degrade groundwater below the site. This is part of the Spokane Valley "sole source" aquifer. It is not considered an economically viable water source, however, and is downgradient from all major water supply wells tapping the aquifer. Alternative C has a present worth capital cost $6,000,000 greater than Alternative A.

Alternative D

Alternative D proposes that separate treatment facilities be constructed to serve both Spokane Valley and North Spokane. Spokane Valley and Moran Prairie would be served by a Felts Field plant (as described for Alternative B) and North Spokane would be served by a land disposal facility on Rutter Parkway. Indian Trail and West Plains would be served by the City plant. Liberty Lake and Newman Lake would eventually tie into the Felts Field plant.

The beneficial aspects of Alternative D are much the same as the preceding alternatives. A central wastewater collection and treatment system would be provided to the large numbers of people now using septic tanks and drainfields over the Spokane Valley Aquifer. In addition, beneficial river uses, fisheries and surface water quality below the City treatment plant discharge would receive the combined benefits of Alternatives B and C. Up to 4.7 MGD of waste flow would be removed from the river and 19 MGD would be relocated 13 miles upstream from the City plant (when compared to Alternative A). This reduction and decentralization of flow would decrease impacts on the downstream portion of the river system (Long Lake).

The Alternative D Felts Field treatment plant discharge, however, poses the same adverse impacts on river uses within the City of Spokane as Alternative B. The Rutter Parkway land disposal facility would also create the same groundwater quality impacts from land disposal described for Alternative C. This total package has a present worth capital cost $35,084,000 in excess of Alternative A.

Alternative E

This alternative provides for land application of wastewater from Spokane Valley, Moran Prairie, and North Spokane at a site located at the Rutter Parkway area downstream of the main Spokane aquifer. Sewage flows from Spokane Valley would be concentrated at the Felts Field site where they would be pumped to the North Spokane system. The sewage from both North Spokane and Spokane Valley would then be concentrated at a site near the fish hatchery and pumped to the Rutter Parkway area where treatment and land application would be provided. Indian Trail and West Plains would be served by the City plant as described under Alternative A. Liberty Lake and Newman Lake would eventually tie into the Spokane Valley interceptor going to North Spokane.

Alternative E provides the same general aquifer protection benefits as the other alternatives. In addition, it avoids major wastewater discharges to the Spokane River in favor of land disposal on the northern fringe of the Spokane Valley Aquifer. Surface water quality, fisheries, and beneficial river uses would not be significantly affected by the wastewater disposal. The land disposal facility near Rutter Parkway would remove 300 acres of grassland in a presently scenic area and the wastewater percolating from the site would eventually degrade the northernmost fringe of the Spokane Valley Aquifer. This portion of the aquifer is not expected to be a significant source of water in the future. The combined surface and groundwater benefits of Alternative E have a high present worth capital cost, however-$29,139,000 higher than Alternative A.

Alternative F

All County areas with the exception of North Spokane would be conveyed to the City plant for treatment; phosphorus removal would not be required. Flows from North Spokane would be conveyed to a site located near the confluence of the Spokane and Little Spokane Rivers where treatment would be provided. All wastewater plant effluent would be pumped to a downriver land application site located on the bluff north of Long Lake in Stevens County.

Alternative F avoids any surface water discharge of County wastewater and also removes the City of Spokane's discharge. This would provide the maximum benefit to water quality, fisheries and beneficial uses in the Spokane River within the facilities planning area. In addition, it avoids any sizable wastewater disposal over or tributary to the Spokane Valley Aquifer. In order to accomplish this water quality improvement, a land disposal facility would be constructed on 727 acres of grassland and forest in Stevens County, adjacent to Long Lake. Eight acres of prime farmland would also be lost to a treatment plant at the confluence of the Spokane and Little Spokane Rivers. This alternative has the highest present worth capital cost of all the action alternatives, $38,689,000 greater than Alternative A.

Costs

The present worth capital costs of each alternative were listed above and are summarized in Table 1. These numbers were developed to meet facilities planning cost comparison requirements. They do not represent the actual capital expenditures that can be expected from each project, nor do they indicate what relative portion of the costs might be paid for from federal, state and local funds. This more detailed information has not been developed in the facilities planning effort.

Although the facilities planners have provided preliminary estimates of local user costs that would result from the alternatives, these costs do not reflect realistic estimates. They were based on incomplete capital cost estimates, and did not take into consideration federal and state grant assistance or the cost of financing local capital expenditures. They were developed for comparative purposes only.

EPA feels that the user costs should reflect the County's grant funding expectations, the capital costs of all facilities, including local collection systems, and the costs of financing the local share of the capital costs.

Future EPA Action

This EIS is the principal document used by EPA to make a grant offer decision on the County's CWMP project. Spokane County is currently on the 201 construction grant priority list for funding of the North Spokane interceptor. The Draft EIS has analyzed Phase I and Phase II of the CWMP in order to make an informed decision on Spokane County grant requests. The Phase I user cost information is not complete but will be upgraded by the County before EPA completes a Final EIS and makes a decision on Phase I funding.

There are currently no plans to provide federal funds for any other portions of the CWMP facilities. If, at some later date, the County makes federal funding requests for Phase II facilities, it is possible that additional National Environmental Policy Act (NEPA) analysis would be necessary prior to grant decisions.

Table 1. Project Alternatives Cost Summary

	Present Worth		
Alternative	Capital	Operation & Maintenance	Total
A	57,525,000	24,171,000	82,696,000
B	83,043,000	25,538,000	108,581,000
C	63,525,000	24,385,000	87,910,000
D	92,609,000	24,751,000	117,360,000
E	86,664,000	28,132,000	114,796,000
F	96,214,000	26,391,000	122,605,000

NOTE: All costs in June 1980 dollars.

SOURCE: Modified from Economic and Engineering Services, Inc., 1980b.

Chapter 1

Existing Wastewater Facilities and Alternative Management Plans

Chapter 1

EXISTING WASTEWATER FACILITIES AND ALTERNATIVE MANAGEMENT PLANS

The Study Area

The overall boundary for the study area is called the Wastewater Management Area (WMA), as shown in Figure 2. The WMA represents an overall area which was initially selected for the study of sewerage needs by the Comprehensive Wastewater Management Plan (CWMP). The City of Spokane, while encompassed by the WMA, is not included in the CWMP. However, the City's wastewater treatment facility and the carrying capacity of certain major interceptors are key considerations in the CWMP. When the WMA was selected, it was recognized that some areas were included which would probably not be sewered in the near future, but it was felt that a larger area would be beneficial to future planning efforts. Within the WMA are several smaller, more defined areas. One is the General Sewer Service Area (GSSA), which includes areas which will probably be sewered prior to year 2002. The Priority Sewer Service Area (PSSA) is smaller than the GSSA, and represents the area which probably will be sewered in Phase I of the CWMP (prior to year 1992) (Figure 1-1).

Existing Sewerage Collection and Treatment Facilities

City of Spokane Facilities

The City of Spokane, although not included in the CWMP, is important because major interceptors and the treatment facility have varying uses in the CWMP alternatives. The majority of the sewers in Spokane are combined sewers carrying both wastewater and stormwater runoff. During rainstorms and periods of snowmelt, the downstream interceptors in the collection system reach their maximum flow capacity, and in order to prevent sewer backups, it is necessary to overflow raw wastewater directly into the Spokane River. These discharges are referred to as combined sewer overflow (CSO), and the solution to these overflows has previously been addressed in two facilities planning reports (*Facilities Planning Report for Sewer Overflow Abatement*, prepared by the Spokane City Department of Public Works [1977] and *Facilities Planning Report for Sewer Overflow Abatement*

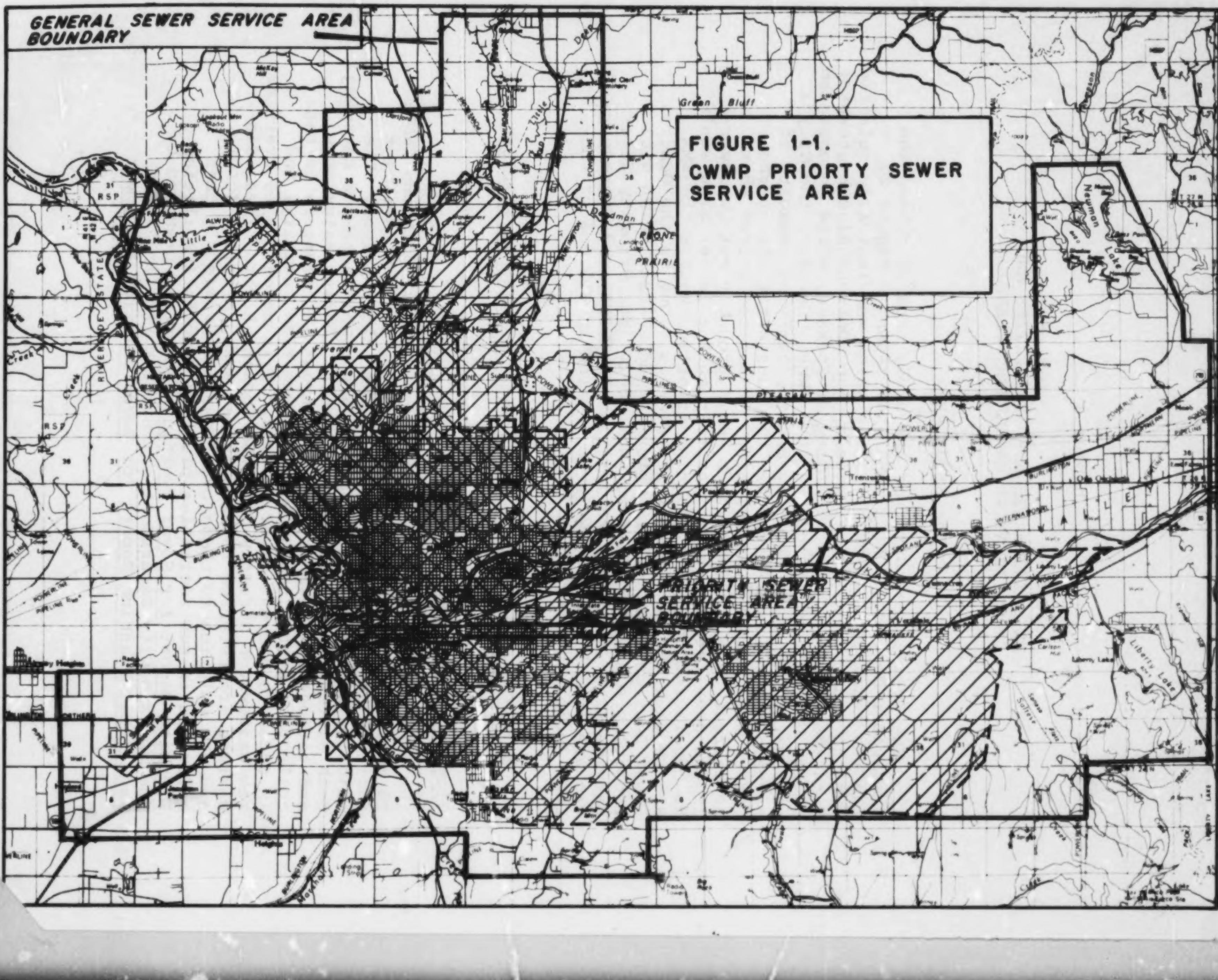


FIGURE 1-1.
CWMP PRIORTY SEWER SERVICE AREA

prepared by Bovay Engineers [1979]) and an U. S. Environmental Protection Agency (EPA) Environmental Impact Statement (EIS) entitled City of Spokane Combined Sewer Overflow Abatement Project, prepared in 1978.

The result of these facilities planning documents and the EPA EIS was the decision to separate the stormwater and wastewater flows by constructing a new storm sewer system. Phase I of the storm sewer system is presently in the design stage, and will probably be constructed at some time in the near future.

The City of Spokane owns and operates a 44-million-gallon-per-day (MGD) advanced wastewater treatment (AWT) plant, which provides phosphorus removal. The plant is located on the north bank of the Spokane River, just below the Downriver Municipal Golf Course, and discharges to the Spokane River. The plant has an average daily dry weather flow capacity of 44 MGD, and a peak wet weather flow capacity of 77 MGD. Located at the same site is a stormwater treatment plant, which provides clarification and disinfection of wet weather flows in excess of 77 MGD (Bovay Engineers 1979). There is sufficient land area available at the plant site to allow the 44 MGD AWT facilities to be expanded to a capacity of 66 MGD, although such an expansion would require the use of facilities presently used for the stormwater treatment.

North Spokane Area

A second area which is sewered or partially sewered is the North Spokane area. North Spokane includes the area generally north of the City of Spokane, which has a natural drainage to the confluence of the Little Spokane River and the Spokane River. North Spokane includes mainly unincorporated areas, although some portions of the City of Spokane are included in the North Spokane area. Septic tanks and drain fields are being used for wastewater treatment and disposal in most of the area, although there are 12 "interim" treatment facilities serving small commercial developments, some small residential developments, and Whitworth College. Of these 12 facilities, 6 are owned and operated by the City of Spokane, 2 are owned and operated by the County, and 4 are privately owned and operated. The total treatment capacity of these 12 facilities is estimated to be about 0.25-0.30 MGD. All of these facilities were constructed with the understanding that they would be phased out when a comprehensive sewer system was constructed in North Spokane.

In addition to the 12 interim commercial/residential treatment facilities in the North Spokane area, there are also two industrial treatment facilities. One is the Kaiser Aluminum and Chemical Corporation Mead Works and the other is the Kaiser South Mead Works. At the Mead Works, about 0.2 MGD of sanitary waste receives secondary treatment prior to discharge to a tributary of the Little Spokane River. At the South Mead Works, an activated sludge treatment plant is used to treat a small volume of sanitary wastes, with the treated effluent being discharged to a seepage lagoon.

Liberty Lake and Newman Lake

In the Liberty Lake Sewer District, there is currently only a small primary treatment facility near the lake. It services 75 lots and discharges effluent over the land which subsequently percolates subsurface. However, plans and specifications have been completed for a 1.0 MGD secondary treatment facility, which would discharge to the Spokane River.

Planning for sewers is also underway in the Newman Lake area of the County. Present plans are to construct low pressure sewers, and to convey the wastewater to the proposed Liberty Lake treatment plant. This is considered a Phase II project in the CWMP.

Spokane Valley, Moran Prairie, and West Plains

There are no definitive plans to construct sewers in these areas until the CWMP is completed. Most residences are served by on-site waste disposal systems or small community systems. Data compiled for the Spokane County 208 study indicate there are at least 49 separate small systems in the Spokane Valley planning area, each serving from 25-425 housing units (Spokane County Office of County Engineer 1979b).

Project Alternatives Developed by the CWMP

Introduction

In the CWMP's development of alternative plans for wastewater treatment, it was first necessary to develop a project phasing schedule and an estimate of future wastewater flows from tributary areas. Project scheduling was divided into two phases: Phase I from 1982-1992 and Phase II from 1992-2002. Table 1-1 presents estimated wastewater flows from the various planning areas for Phases I and II.

Table 1-1. Projected Wastewater Flows for Phases I and II

	1992 Phase 1		2002 Phase 2	
Planning Area	ADWF (MGD)	PWWF (MGD)	ADWF (MGD)	PWWF (MGD)
North Spokane	3.6	5.4	4.7	7.0
Indian Trails	0.74	1.1	1.23	1.86
Spokane Valley and Moran Prairie	9.0	13.5	15.5	23.25
Liberty Lake and Newman Lake	*	*	3.5	5.25
West Plains	**	**	2.6	3.9

* Tributary to the proposed Liberty Lake plant in Phase I.
** Not to be sewered until Phase II.

Note - ADWF is Average Dry Weather Flow and PWWF is Peak Wet Weather Flow. PWWF is estimated based upon the use of storage/equalization basins during wet weather conditions.

SOURCE: Economic and Engineering Services, Inc. 1980.

Impact of CWMP Sewering on CSO in the City of Spokane

Several of the alternatives developed in the CWMP would use portions of the City of Spokane's interceptor system to convey raw wastewater to the City's existing treatment facility, and to treat the raw wastewater at this facility. However, without some method of controlling the discharge rate of wastewater from the CWMP planning area into the City's interceptor system, or the construction of storm sewers in the City of Spokane, such connections would only accentuate the problem of CSO control in the City. There are two solutions which are available to keep CSOs from increasing if portions of the CWMP planning area are connected to the City's interceptor system. The first solution would be to implement the City's present plan to construct storm sewers. Such construction would eliminate stormwater from the sanitary sewer system, and would provide additional capacity for raw wastewater from the CWMP planning area, as well as from the City of Spokane. As previously discussed, plans and specifications are presently being completed for Phase I of the storm sewer system. However, there is presently no definitive schedule for the construction of either the Phase I or Phase II storm sewers.

The second solution would be to store raw wastewater generated in the CWMP planning area during wet weather conditions, and then to gradually release this stored wastewater into the City's system when capacity is available. The advantage of this approach is that sewering of the CWMP planning area could begin, even if Spokane's Phase I storm sewer separation project had not begun. In other words, use of the proposed storage/equalization basins would allow the CWMP sewering to proceed without increasing CSO from the City of Spokane's system and without requiring the City's storm sewer separation project to proceed immediately.

Project Alternatives

Six different alternatives were developed by the CWMP. The basic concepts of the alternatives are:

Alternative A - All CWMP areas to expanded Spokane plant.
Alternative B - North Spokane to expanded Spokane plant. Other areas to a new plant.
Alternative C - Spokane Valley and Moran Prairie to expanded Spokane plant. Other areas to a new plant.
Alternative D - Two new treatment facilities, one for North Spokane and one for Spokane Valley.
Alternative E - One new treatment facility serving North Spokane and Spokane Valley. Land application of effluent.

Alternative F - North Spokane to a new treatment facility. Other areas to expanded Spokane plant. Land application of effluent from both plants.

A more detailed description of each of these alternatives and the no-action option is presented in the following section.

No-Action Alternative. EPA regulations for the preparation of an EIS require that a "no-action" alternative be evaluated and compared with other alternatives under consideration. The no-action alternative for the CWMP would be the continued utilization of septic tanks in the unsewered areas, the continued use of the small "interim" wastewater plants in the North Spokane area, and the probable use of new septic tank systems for future development. Continued use of septic tanks would allow continued degradation of the groundwater quality in the underlying aquifer.

Alternative A - Regional Treatment at Spokane Plant. In this concept, new interceptors would be constructed to transport wastewater into the City's system, and flow/equalization basins would be used for each major interceptor. Figure 1-2 shows the location of the storage basins and the major interceptors. In the North Spokane area, wastewater would be concentrated near Hawthorne Road and then be diverted to an equalization/storage basin to be constructed on the site of the existing Lidgerwood lagoons near Holland and Dakota. The equalization/storage facility would be constructed by lining the existing lagoons with a clay or PVC liner, and then covering with sand and asphalt. Ultimately, a land area of 22 acres would be required. From the equalization/storage basin, flow would be pumped into the City system near Rowan and Milton.

In the Spokane Valley, the majority of flow would be by gravity, with pumping only being required in some outlying areas. Interceptors which would be required are shown on Figure 1-2. Initially, a flow equalization/storage basin would be constructed just east of the city limits. Two alternative locations are available, as shown on Figure 1-2, and both locations are existing gravel pits. These gravel pits would be backfilled to a depth of 10 feet, and sealed as described above. Ultimately, 43 acres of open storage would be required. The interceptor from Moran Prairie would flow by gravity to the equalization/storage basin located in the Spokane Valley.

In the Indian Trail area, a new gravity interceptor would be used between a storage/equalization basin and the City's existing system. The location of the proposed equalization basin is shown in Figure 1-2, and 4 acres of open storage would ultimately be required. Use of some pumping stations

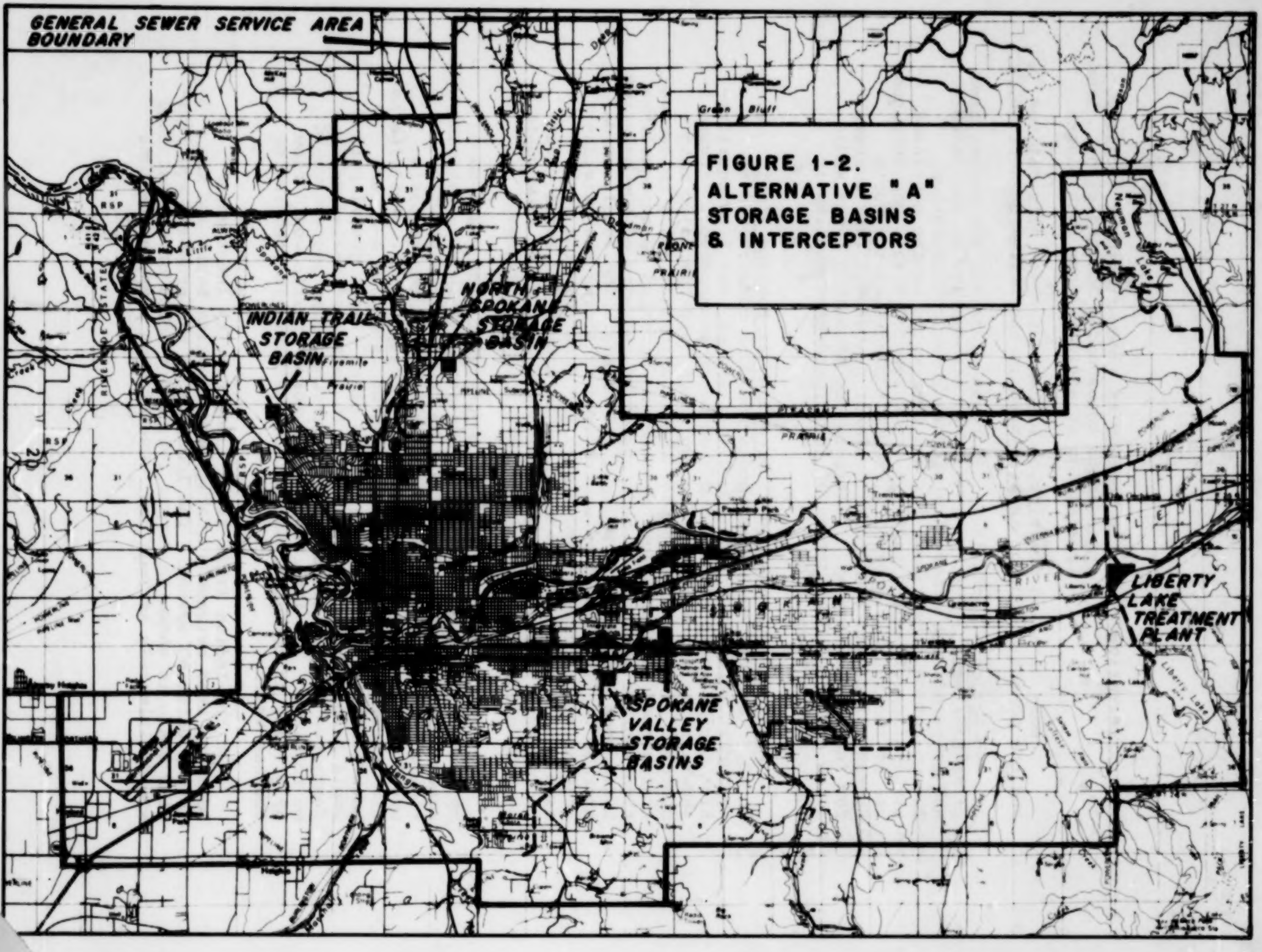

GENERAL SEWER SERVICE AREA BOUNDARY
Green Bluff
Newman Lake
NORTH SPOKANE STORAGE BASIN
INDIAN TRAIL STORAGE BASIN
Prairie
SPOKANE RIVER
LIBERTY LAKE TREATMENT PLANT
Liberty Lake
SPOKANE VALLEY STORAGE BASINS

FIGURE 1-2.
ALTERNATIVE "A"
STORAGE BASINS
& INTERCEPTORS

and force mains will be necessary in the south and west portions of the Indian Hills area.

In Phase I of the CWMP, Liberty Lake and Newman Lake flows would be treated at the new treatment plant to be constructed at Liberty Lake. This plant would provide secondary treatment (plus phosphorus removal if flows exceed 1 MGD), and would discharge to the Spokane River. Flow from Newman Lake to the new treatment facility would require some pumping. In Phase II of the CWMP, the Spokane Valley interceptor would be extended out to the treatment plant site, and the treatment facility would be abandoned.

The West Plains area would not be served in Phase I, because of the low population density. In Phase II, a new interceptor would be constructed directly to the City's treatment facility. The CWMP does not indicate a route for this interceptor. An equalization/storage facility is not planned because wastewater flows are expected to be quite small (Maxwell pers. comm.).

Alternative B - Separate Treatment for Spokane Valley. In this alternative, a new treatment facility would be constructed to serve the Spokane Valley and Moran Prairie. This facility would be located near the east end of Felts Field, as shown on Figure 1-3, and would provide secondary treatment plus phosphorus removal. Discharge would be directed to the Spokane River. A land area of 29 acres would be required for the treatment facility.

Other areas would be served as described in Alternative A. North Spokane and Indian Trail would be treated at the existing City plant; Liberty Lake and Newman Lake would use the new Liberty Lake treatment plant in Phase I, and West Plains would not be served until Phase II. In Phase II, when the Spokane Valley interceptor is extended to Liberty Lake, the Liberty Lake plant proposed for Phase I would be abandoned, and wastewater from Liberty Lake and Newman Lake would be treated at the new Spokane Valley plant proposed to be constructed in Phase I of this alternative.

Alternative C - Separate Treatment for North Spokane. With the exception of the North Spokane area, all areas would be treated identically to Alternative A. For North Spokane, all flow would be conveyed by gravity to a point near the fish hatchery at Waikiki Road and Rutter Parkway, where a pumping station would be constructed to pump it to a new treatment plant. The site of the new facility would be just south of Rutter Parkway, and about 1.5 miles east of the Spokane River. The location of the proposed treatment plant site is shown in Figure 1-4. No storage/equalization basin

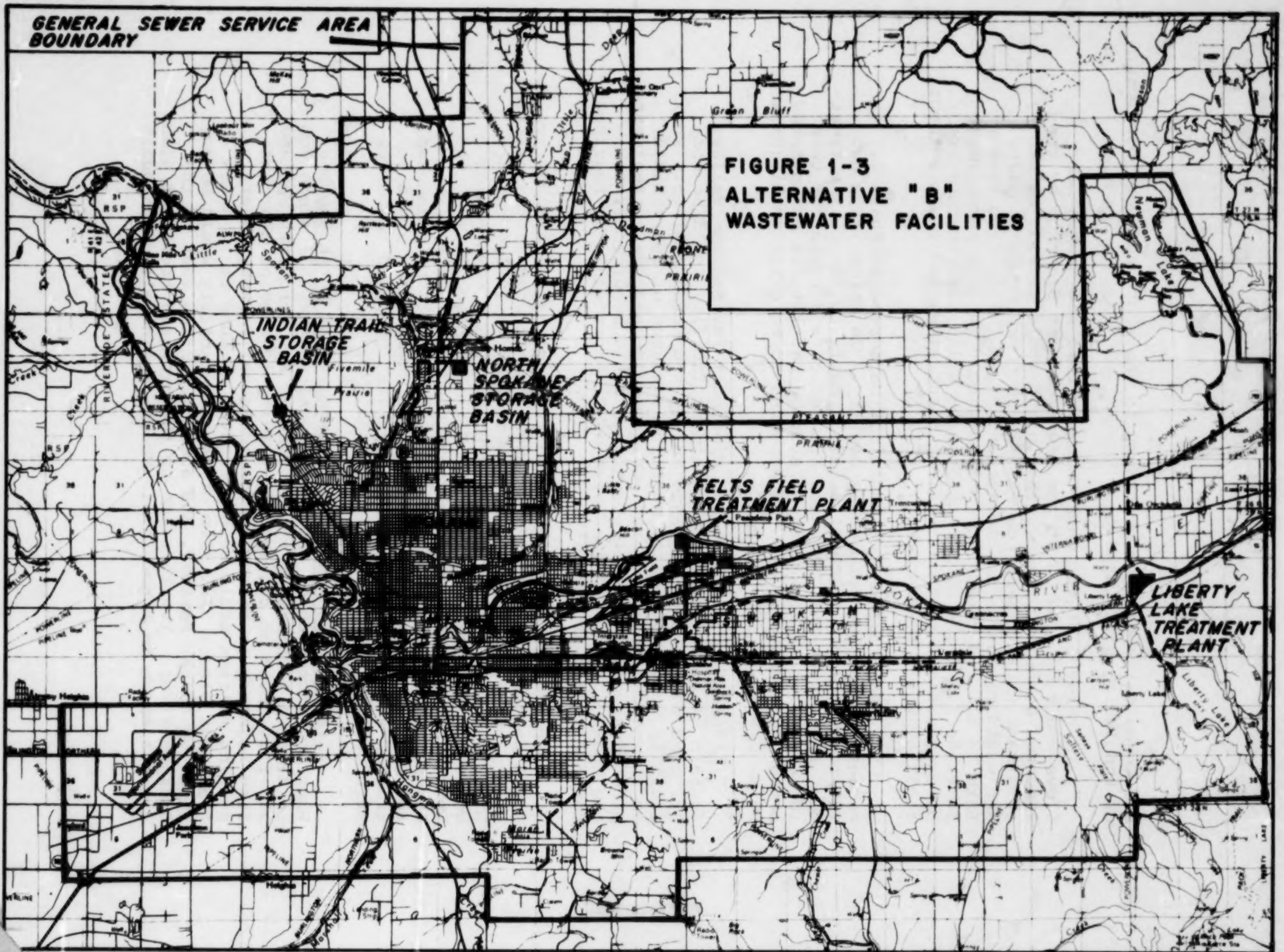


FIGURE 1-3
ALTERNATIVE "B"
WASTEWATER FACILITIES

GENERAL SEWER SERVICE AREA BOUNDARY
INDIAN TRAIL STORAGE BASIN
NORTH SPOKANE STORAGE BASIN
FELTS FIELD TREATMENT PLANT
LIBERTY LAKE TREATMENT PLANT
Green Bluff
Newman Lake
Liberty Lake
Fivemile Prairie
SPOKANE
RIVER
RSP

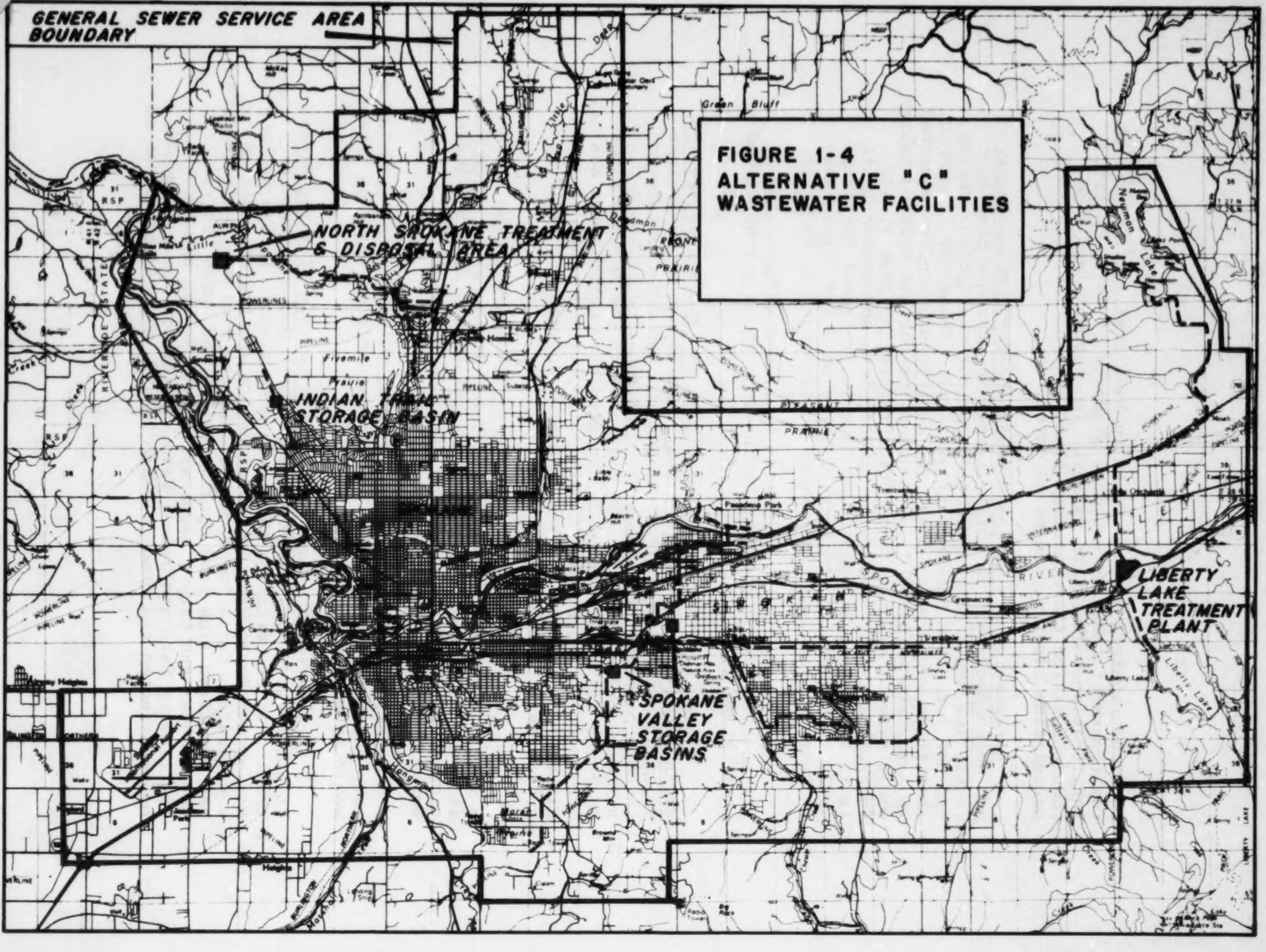


FIGURE 1-4
ALTERNATIVE "C"
WASTEWATER FACILITIES

would be required for the North Spokane area. Effluent from the treatment facility would be disposed of using on-site infiltration/percolation basins. The overall land area requirement for the treatment plant and the infiltration/percolation basins would be 63 acres.

Alternative D - Separate Treatment for Spokane Valley and North Spokane. In this alternative, two new treatment facilities would be constructed, one for the Spokane Valley and one for North Spokane (Figure 1-5). These new treatment facilities would be at identical locations to those described in Alternatives B and C. The new plant for the Spokane Valley would serve the Valley and Moran Prairie in Phase I, and in Phase II would also serve Liberty Lake and Newman Lake. As in Alternatives B and C, an interim treatment facility would be constructed to serve Liberty Lake and Newman Lake in Phase I, and this plant would be abandoned in Phase II.

The Indian Trail area would be served as described in Alternative A, and the West Plains area would not be served until Phase II.

Alternative E - Land Application for Spokane Valley and North Spokane. One new treatment facility to serve Spokane Valley/Moran Prairie and North Spokane would be constructed in this concept. The plant would be constructed south of Rutter Parkway and about 0.5 mile east of the Spokane River. Effluent disposal would be by infiltration/percolation basins. The location of this new treatment facility is shown in Figure 1-6, and the overall land area requirement would be 300 acres.

Flow in the Spokane Valley would be concentrated at a site to the east of Felts Field, and from this location it would be pumped into the North Spokane system. The location of the force main between the Spokane Valley and the North Spokane area is shown in Figure 1-6.

The Indian Trail area would be tributary to the existing City plant in Phase I, and for the West Plains area, no sewers would be constructed until Phase II.

Alternative F - Land Application for All Planning Areas. In Alternative F, all areas except North Spokane would be treated at the existing City treatment plant. In the Spokane Valley and Moran Prairie, interceptors and the storage/equalization basin location would be the same as in Alternative A, and equalized flow from Spokane Valley and Moran Prairie would enter the City's sewer system at Harston and Harvard. For Liberty Lake and Newman Lake, an interim facility would be constructed and used in Phase I, and it would be abandoned

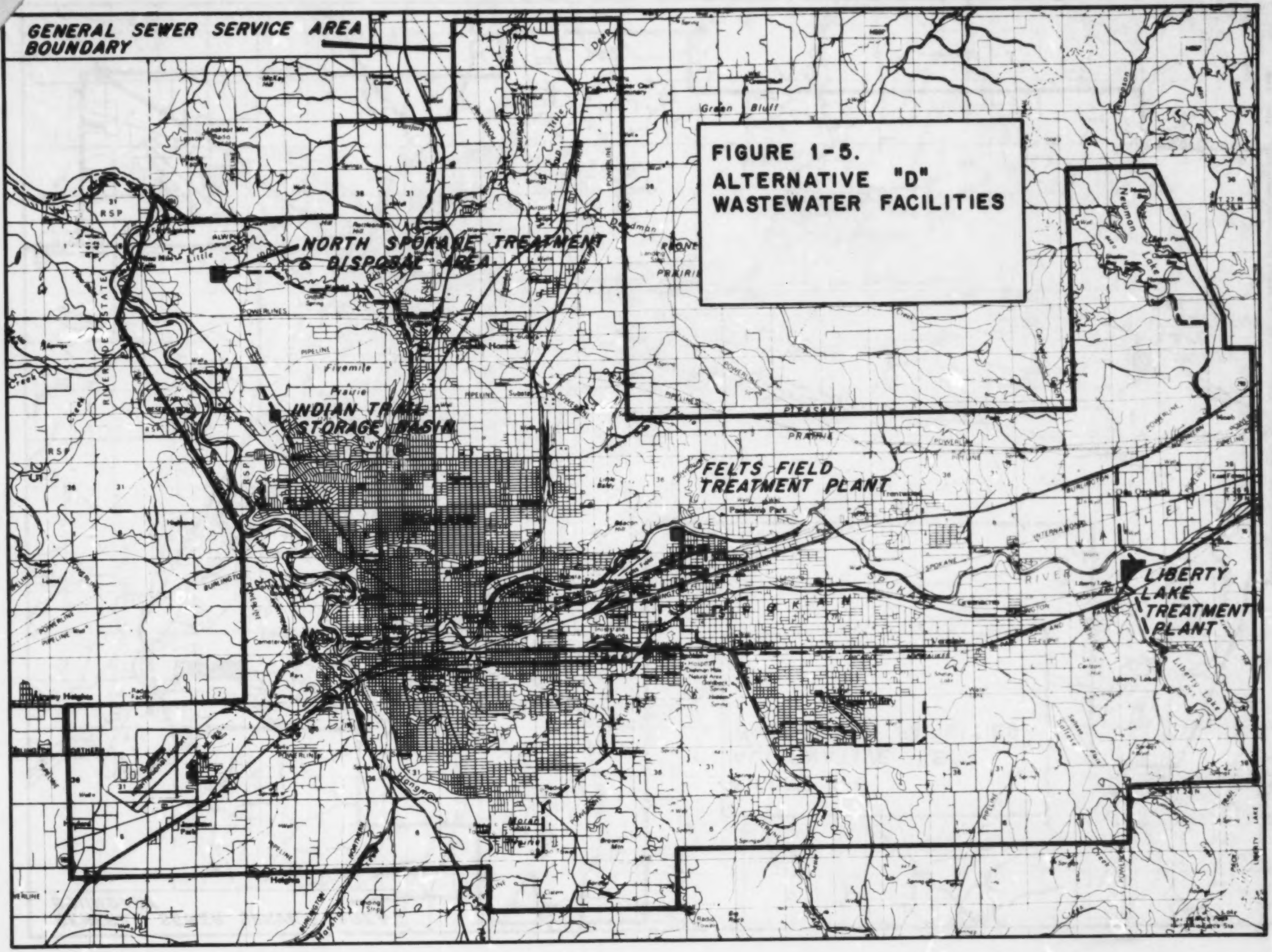


FIGURE 1-5.
ALTERNATIVE "D"
WASTEWATER FACILITIES

GENERAL SEWER SERVICE AREA BOUNDARY
NORTH SPOKANE TREATMENT & DISPOSAL AREA
INDIAN TRAIL STORAGE BASIN
FELTS FIELD TREATMENT PLANT
LIBERTY LAKE TREATMENT PLANT
Green Bluff
Newman Lake
Liberty Lake
SPOKANE RIVER
Fivemile Prairie
PLEASANT PRAIRIE
RIVERSIDE STATE
RSP
Pasadena Park
Hangman
Saltese Flats
PIPELINE
POWERLINE

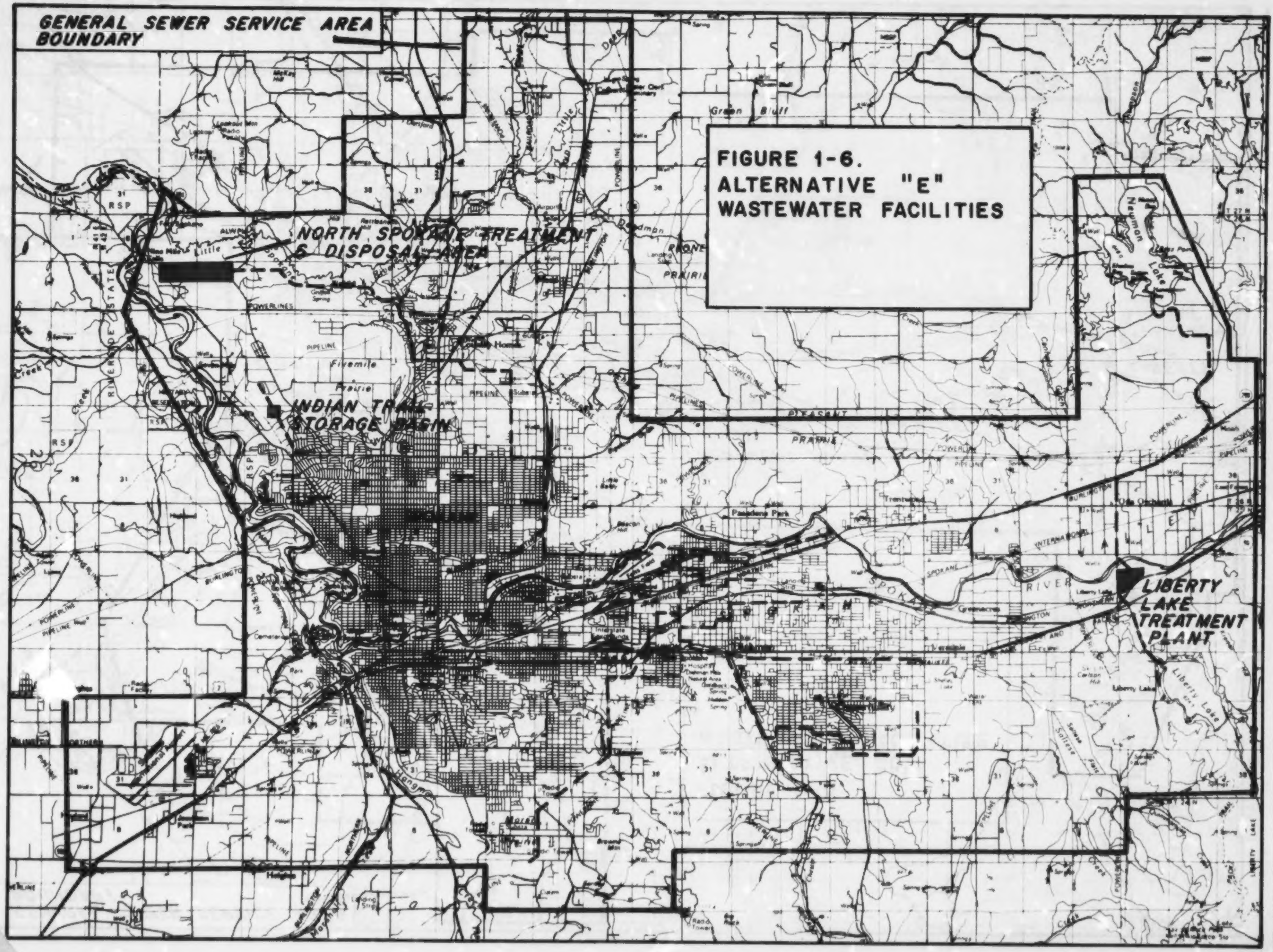


FIGURE 1-6.
ALTERNATIVE "E"
WASTEWATER FACILITIES

in Phase II when the Spokane Valley interceptor is extended. Indian Trail would be served in Phase I by a new interceptor to the City plant, as described in Alternative A. At the existing City plant, no phosphorus removal would be provided.

For the North Spokane area, a new treatment plant would be constructed near the confluence of the Little Spokane and Spokane Rivers. No phosphorus removal would be provided at this plant since the effluent would be land applied. The plant location is shown in Figure 1-7, and 8 acres of land would be required.

Treated wastewater from the City plant would flow in a gravity pipeline to the new North Spokane plant site, where the two treated wastewaters would be combined and pumped to the land application site. This site would be located on a bluff north of Long Lake, as shown on Figure 1-7, and an estimated 727 acres would be required.

Sludge Treatment and Disposal Concepts. Solids handling at the City's plant would follow the same practices as at present; anaerobic digestion, thickening and vacuum filtration, followed by land spreading in the West Plains area or landfilling. For a Spokane Valley or North Spokane plant, sludge treatment would be by anaerobic digestion, thickening, and vacuum filtration. Dewatered sludge from either plant would be disposed of at locations outside of the aquifer sensitive area. At present, the County's Mica landfill is the most likely disposal site if a Spokane Valley plant is constructed and the County's Colbert landfill would be a suitable location if a North Spokane plant is built (Figure 1-8).

Project Alternatives Available to EPA

Overview

EPA's implementation procedures (40 CFR, Part 6) for the National Environmental Policy Act (NEPA) require, in addition to considering alternatives proposed by the grant applicant, that EPA EISs explicitly consider alternatives available to EPA. These alternatives can include structural or locational alternatives not investigated by the grant applicant, or can be administrative only. The administrative options can include such choices as funding or not funding the proposed action; funding portions of the project or funding the project in stages; or providing a reduced or increased level of funding. Administrative options can also relate to grant conditions, including impact mitigations that EPA might wish to make part of any subsequent grant offer to the applicant.

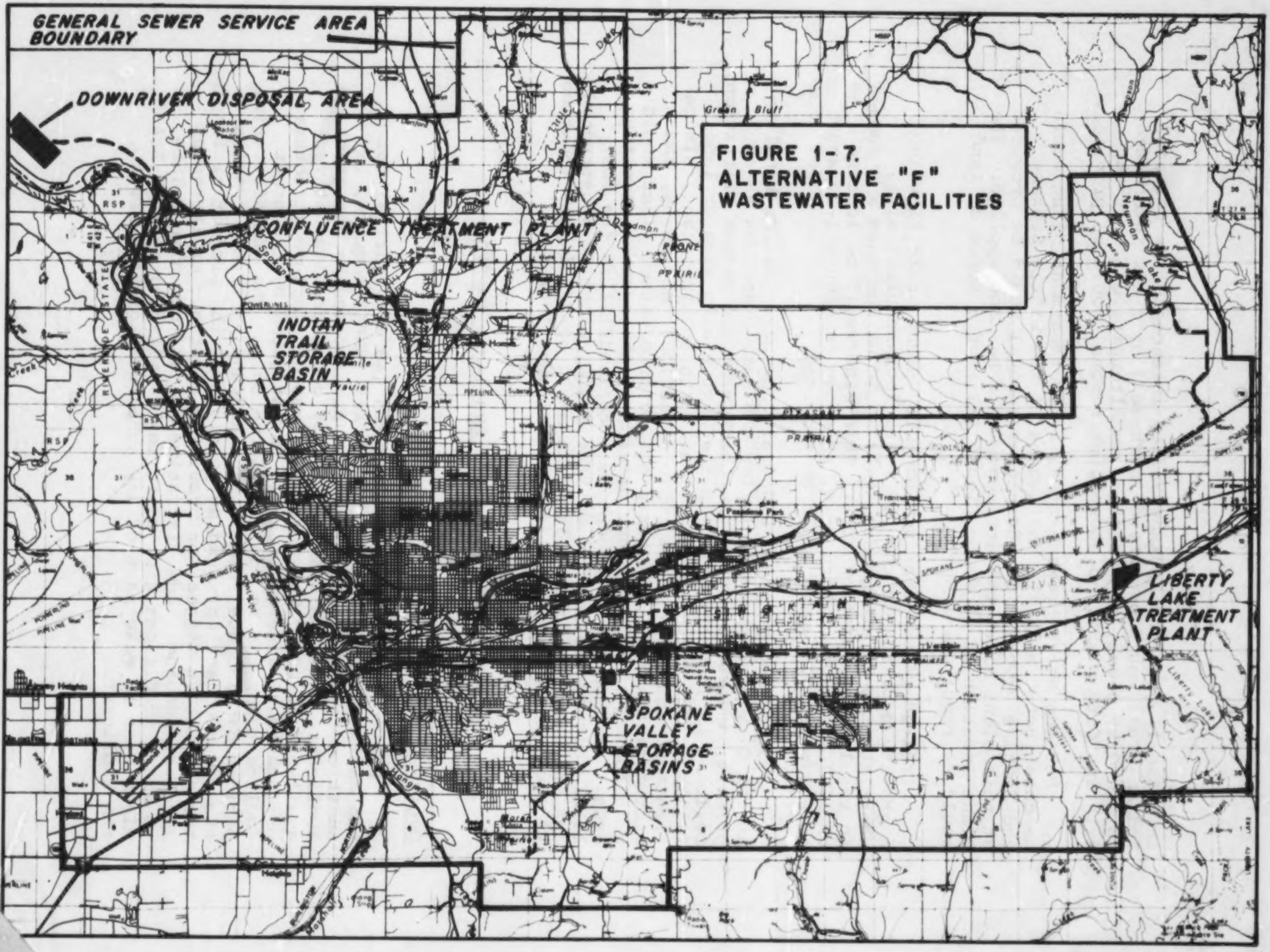


FIGURE 1- 7.
ALTERNATIVE "F"
WASTEWATER FACILITIES

GENERAL SEWER SERVICE AREA BOUNDARY
DOWNRIVER DISPOSAL AREA
CONFLUENCE TREATMENT PLANT
INDIAN TRAIL STORAGE BASIN
SPOKANE VALLEY STORAGE BASINS
LIBERTY LAKE TREATMENT PLANT
Green Bluff
Newman Lake
Liberty Lake
SPOKANE RIVER
PLEASANT PRAIRIE
Pasadena Park

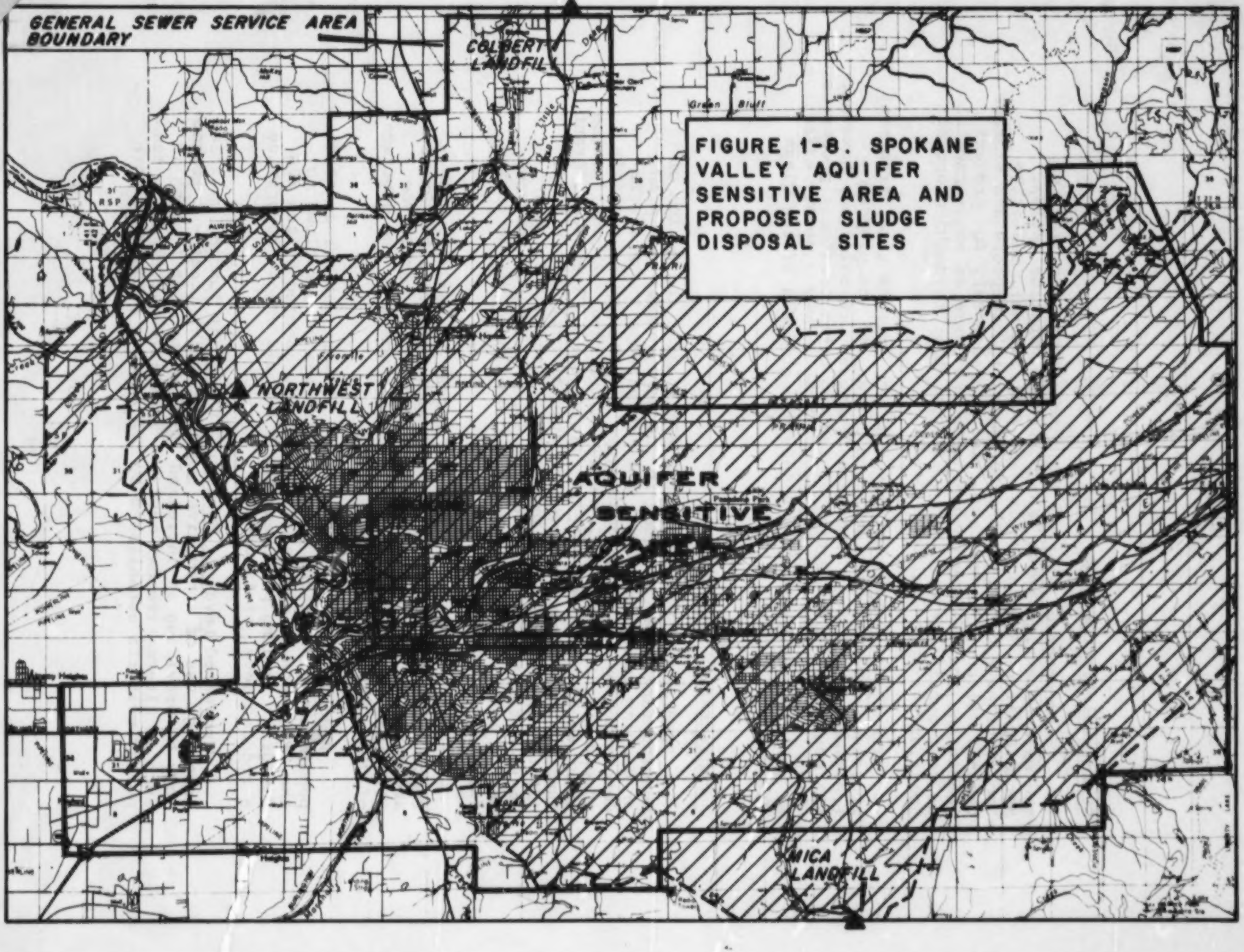


FIGURE 1-8. SPOKANE VALLEY AQUIFER SENSITIVE AREA AND PROPOSED SLUDGE DISPOSAL SITES

Structural Alternatives

Interceptor or Storage Basin Locations. For each of the major planning areas (North Spokane, Spokane Valley, Moran Prairie, Indian Trails, and West Plains), tentative locations have been selected for major interceptors and storage basins. Although these facilities are necessary for project operation, the EPA may determine on the basis of environmental or cost considerations that locations other than the proposed location are more desirable.

Treatment Process Options. At the present time, treatment processes have not been selected for any of the proposed treatment facilities. When the processes are selected, however, EPA would retain the option of funding other treatment processes which it feels are more environmentally and/or fiscally effective at meeting the water quality improvement goals of the Clean Water Act.

Administrative Alternatives

Fund or Not Fund Project. EPA retains the option of funding facilities included in the CWMP recommended plan or denying grant funds. If the preferred alternative is determined by EPA to be cost-effective and environmentally acceptable, federal funding will be provided. A construction grant would be denied only if: (1) federal Clean Water Grant funding sources were removed or significantly diminished; (2) the CWMP's preferred project was found not to be the most cost-effective solution, or (3) the adverse environmental impacts of the proposed project could not be satisfactorily mitigated.

Funding in Stages. EPA may choose to fund the plan recommended by the CWMP in stages different than the Phase I and Phase II construction recommended in the CQMP. The principal reason for funding in stages would be the shortage of Clean Water Grant funds.

Reduced Level of Funding. If it were determined that population projections and projected wastewater flows in the CWMP were in excess of the numbers adopted by the EPA for grant funding purposes, the EPA could choose to provide a reduced level of funding.

Increased Level of Funding. EPA grant funding policies encourage use of innovative and alternative treatment technology by providing an increased level of project funding if such an alternative can meet the innovative/alternative technology criteria established by EPA and the project is both cost-effective and environmentally sound. Grant regulations allow a 15 percent cost-effectiveness preference for alternative processes, and federal funding of design and construction can increase from 75 percent to 85 percent if the project qualifies as an alternative system.

EPA retains the option to provide this increased level of funding if the facilities planning cost analysis can provide the required justification and the EIS process does not identify significant adverse environmental impacts associated with the proposal.

Grant Conditions. If EPA determines that the project selected would result in unacceptable adverse environmental impacts or excessive costs, it may wish to remedy these problems by placing conditions on the award of subsequent grants rather than supporting a different alternative or modifying the funding itself. EPA administrative procedures allow this mitigation approach to be used to place the burden of action on the grant applicant rather than the funding agency. Grant conditions can include specific monitoring requirements, requests for supporting ordinances or a variety of other controls on the construction and operation of the wastewater treatment and disposal facilities.

Chapter 2

Environmental Setting and Consequences of the Alternatives

Chapter 2

ENVIRONMENTAL SETTING AND CONSEQUENCES OF THE ALTERNATIVES

Introduction

This chapter of the report discusses the major environmental issues associated with Spokane County's proposed wastewater facilities plan. The issues have been identified through the planning process and by discussing the project with government agency personnel, local residents and other concerned individuals. Each subsection deals with an individual issue. The issue is identified, pertinent environmental setting data are presented or cited, the relationship of each facilities plan alternative to the issue is discussed and mitigation measures are suggested where significant adverse environmental impacts have been identified.

Tables 2-40 through 2-46 at the end of the chapter (pages 179 through 185) summarize the more important environmental impacts and mitigations of each project alternative. Table 2-39 lists those impacts that are common to each of the six "action" alternatives.

Significant Construction Impacts

Construction of wastewater facilities typically results in an assortment of short-term nuisance impacts to man. This includes the production of noise, dust, and aesthetic disruptions as well as creation of temporary access problems and safety hazards. These impacts are usually insignificant, temporary and readily mitigable. A brief description of these relatively minor construction impacts is presented below. More significant construction-related losses of prime agricultural land, wetlands, and valuable wildlife habitat are mentioned in later sections of this chapter.

To avoid repetition, this discussion has been organized into short segments about each of the major facilities rather than each project alternative. Several of the facilities would be part of more than one alternative, but each is discussed only once below. Table 2-1 indicates which facilities would be constructed in each of the six alternatives. The no-action alternative would have no construction disruptions.

Table 2-1. Listing of Facilities to be Constructed for the Proposed Project Alternatives

New Wastewater Facility	CWMP Alternative					
	A	B	C	D	E	F
Felts Field treatment plant		x		x		
Spokane Valley primary storage basin	x		x			x
Spokane Valley alternative storage basin	x		x			x
North Spokane storage basin	x	x				
Indian Trail storage basin	x	x	x	x	x	x
North Spokane treatment and disposal site			x	x	x	
Confluence treatment plant						x
Downriver disposal site						x
Interceptor system	x	x	x	x	x	x

Felts Field Treatment Plant

Land grading and construction of treatment facilities at the Felts Field site (Figure 2-1) would cause temporary noise, dust, and visual detractions in a residential area. Homes on Park Road, South River Way and Bridgeport Avenue would be most directly affected. The neighborhood playground on Park Road at the eastern edge of the site would also be affected. Heavy equipment and trucks moving to and from the site would create a traffic hazard along Park Road, the most likely access route.

Spokane Valley Primary Storage Basin

The proposed Spokane Valley storage facility (Figure 2-1) is also located in a residential area. Homes on 8th Avenue, 12th Avenue, Carnahan and Stanley would be affected by construction noise and dust. Construction-related traffic would temporarily affect Carnahan or 8th Avenue, or both.

Construction of the storage basin at this site requires backfilling the existing gravel pit to a depth of 10 feet from the surrounding land surface. The source of this fill material has not been identified, but if it is trucked in, the construction-related traffic hazard could be severe on the chosen access route. Streets in this area are quite narrow.

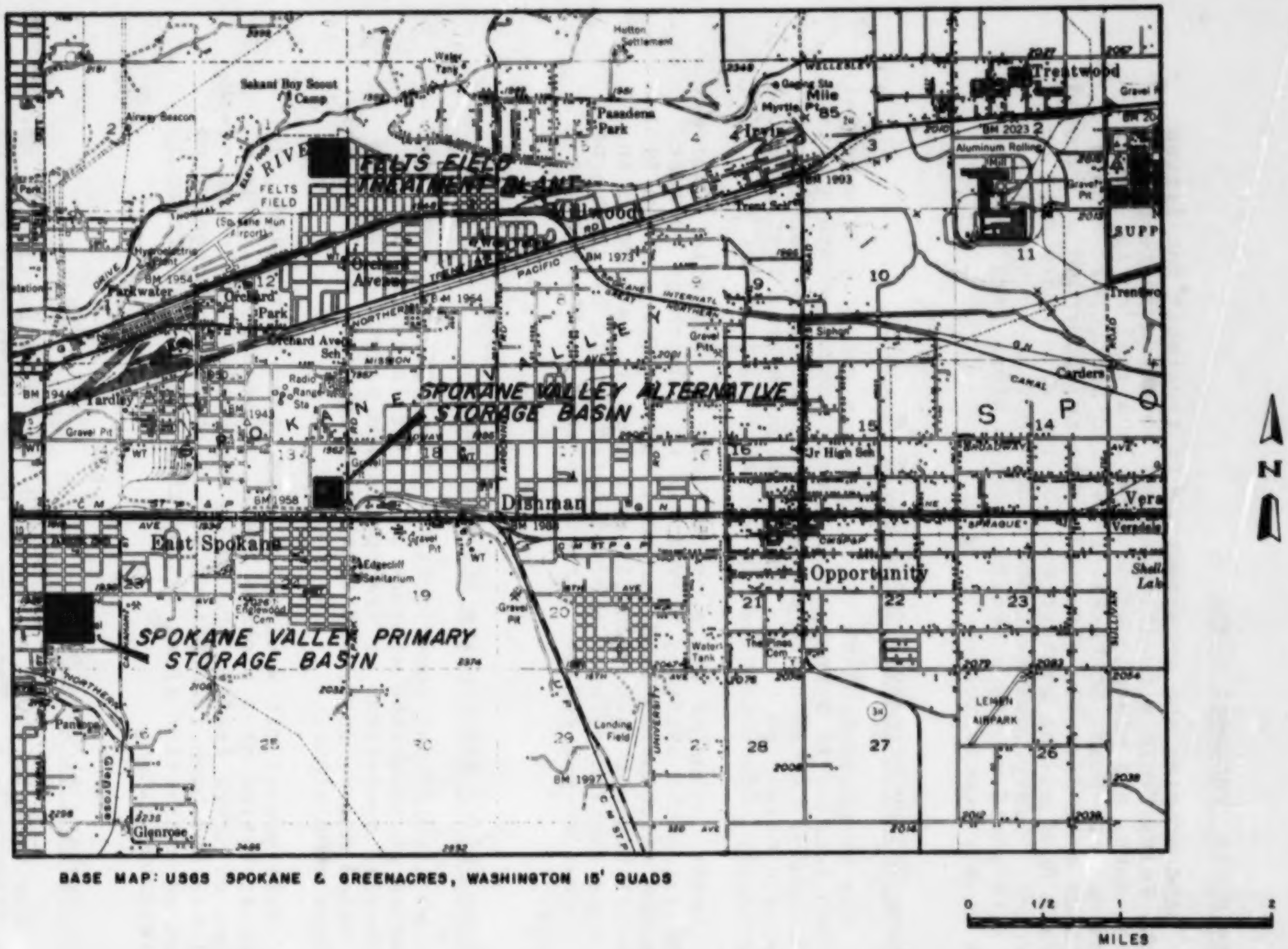
Spokane Valley Alternative Storage Basin

No significant construction-related impacts would be expected at this site (Figure 2-1). It is surrounded by industrial operations or transportation rights-of-way, so the added noise, dust, and truck traffic would not be likely to draw complaints.

This gravel pit would also have to be backfilled prior to construction of a storage basin. Therefore, a large volume of truck traffic should be expected. The source of the fill has not been identified, but it should be sought from existing extraction sites rather than excavating presently undisturbed sites.

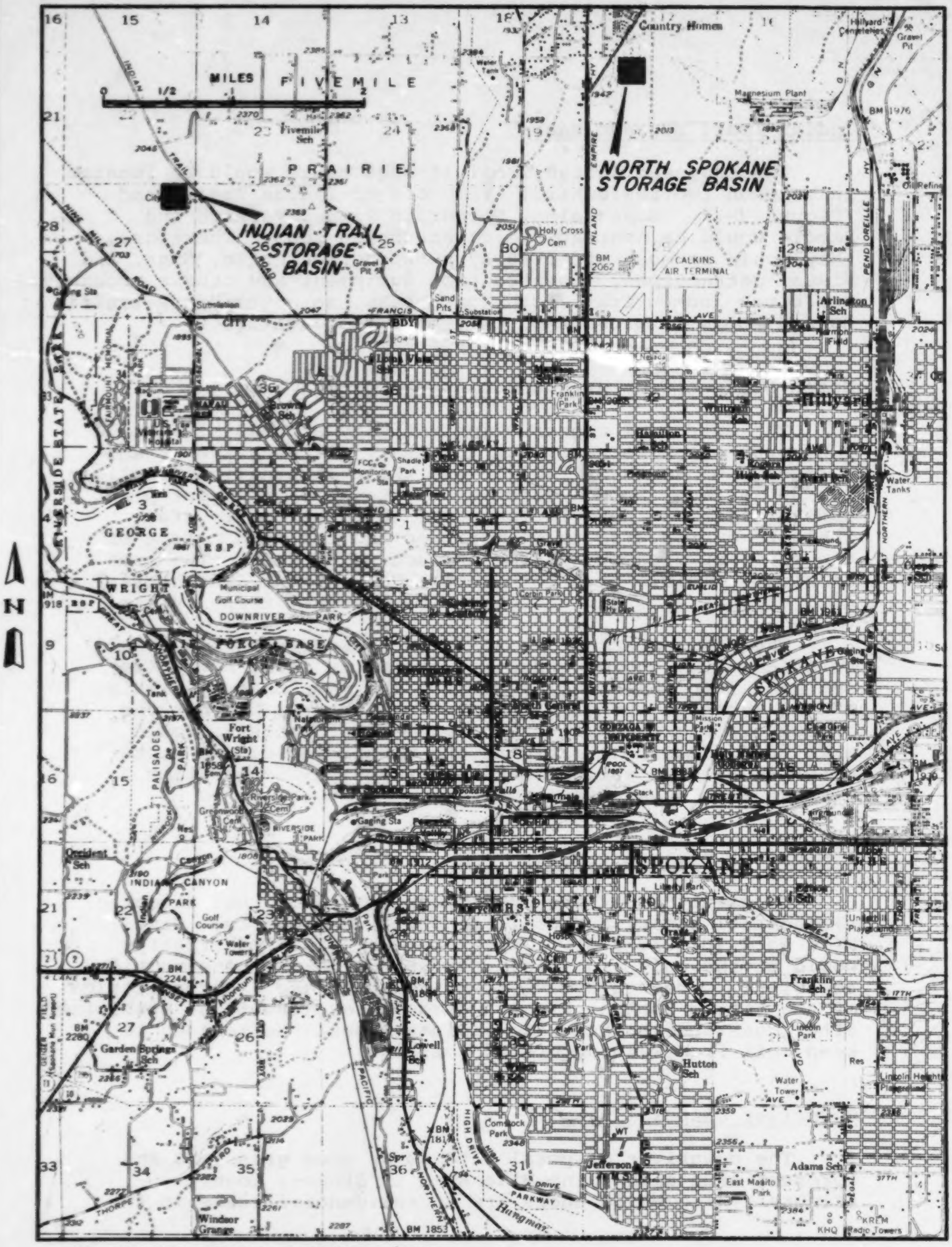
North Spokane Storage Basin

Few impacts would be expected from construction at this site (Figure 2-2). There are no homes immediately adjacent to the area and traffic access is readily available from Highway 2.



BASE MAP: USGS SPOKANE & GREENACRES, WASHINGTON 15' QUADS

FIGURE 2-1. SPOKANE VALLEY TREATMENT & STORAGE FACILITIES



BASE MAP: USGS SPOKANE, WASHINGTON 15' QUAD

FIGURE 2-2. NORTH SPOKANE & INDIAN TRAIL STORAGE FACILITIES

Indian Trail Storage Basin

The proposed Indian Trail storage basin would be located in between two residential areas off of Indian Trail Road (Figure 2-2). Homes along Sutherlin Place, Valerie and Pamela would be nearest the construction zone. Therefore, they would be most affected by construction noise, dust, and visual detractions. Construction equipment and trucks probably would use Indian Trail Road for access, so a temporary traffic hazard would be present on this main thoroughfare.

North Spokane Treatment and Disposal Site

The extent of construction activity at this site would vary from one alternative to the next. Alternatives C and D require 63 acres of facilities, while Alternative E calls for 300 acres. Both a secondary wastewater treatment plant and infiltration/percolation ponds would be constructed. The size of the area to be modified and the open nature of the site would encourage the production of dust. The area is highly visible from both Rutter Parkway and Indian Trail Road (Figure 2-3) and presents a very pleasant open vista.

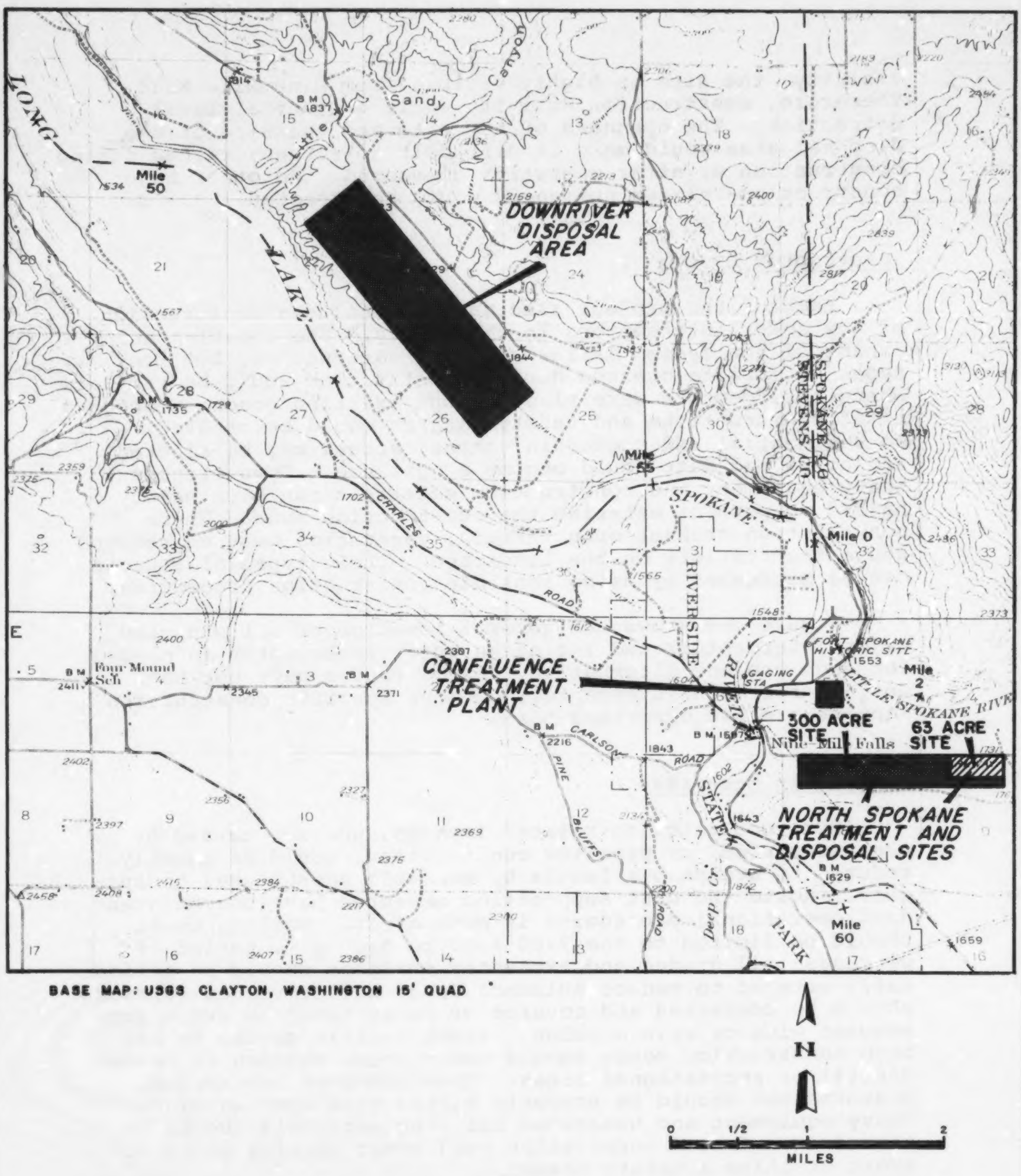
The few homes that exist north of Rutter Parkway would be affected by the construction activity. Most homes are set back into the trees, away from the main roadway. This should decrease the visual and noise impacts, but not the effects of blowing dust. The openness of the site would make it difficult to mitigate the visual impact the wastewater facilities would create on travelers along Rutter Parkway and Indian Trail Road.

Confluence Treatment Plant

Construction at the confluence site would not affect residential areas, but would be highly visible from Nine Mile Road (Figure 2-3). This temporary visual detraction would be the only significant influence of the construction activity. Care would have to be taken to avoid any siltation of the Little Spokane River. Graded areas should be stabilized after construction and site drainage should be managed to keep soil from washing off of the site.

Downriver Disposal Site

The downriver disposal site is an open grassland and forested area along Nine Mile Road in Stevens County (Figure 2-3). While there are no residential areas in the



BASE MAP: USGS CLAYTON, WASHINGTON 15' QUAD

FIGURE 2-3. NORTH SPOKANE, CONFLUENCE AND DOWNRIVER TREATMENT AND DISPOSAL FACILITIES

vicinity, the site is highly visible from Nine Mile Road. Therefore, construction activity would present a visual detraction. The openness of the site and the size of the disposal area would make it difficult to screen, either during construction or after operation commenced. No other major construction-related nuisances would be expected.

Interceptor System

Each of the project alternatives includes construction of new sewer interceptors in the county. The location and extent of the system varies with the alternative, but the types of impacts created during construction would be similar. Where interceptors were placed along existing roads, temporary traffic disruptions and safety hazards would be created. In residential and commercial areas, access may be blocked and noise and dust could become a nuisance. Open trenches, heavy equipment and construction materials can be a safety hazard to persons entering the construction zone. Where construction crosses open terrain, vegetation must be removed and a scar is left on the landscape. These types of impacts can be mitigated by using sensible construction procedures.

Figure 2-4 shows the general location of all proposed major interceptors and indicates which interceptor is needed for each project alternative. Exact routes have not been defined for each interceptor, so more specific construction impacts are not described here.

Mitigation Measures

Most construction-related impacts, whether caused by treatment plant or pipeline construction, could be readily reduced to acceptable levels by sensible operational techniques. Noise and dust suppression measures have become standard operational procedures in most areas. Working hours should be limited to the 7:00 a.m. to 5:00 p.m. period of weekdays; all graded and excavated surfaces should be periodically watered to reduce nuisance dust, and disturbed surfaces should be compacted and covered or revegetated to avoid subsequent wind or rain erosion. Truck traffic moving to and from construction zones should use extreme caution in residential or recreational areas. Open trenches and surface disturbances should be properly marked with warning signs. Heavy equipment and hazardous building materials should be stored in a fenced corporation yard after working hours to avoid creating a safety hazard.

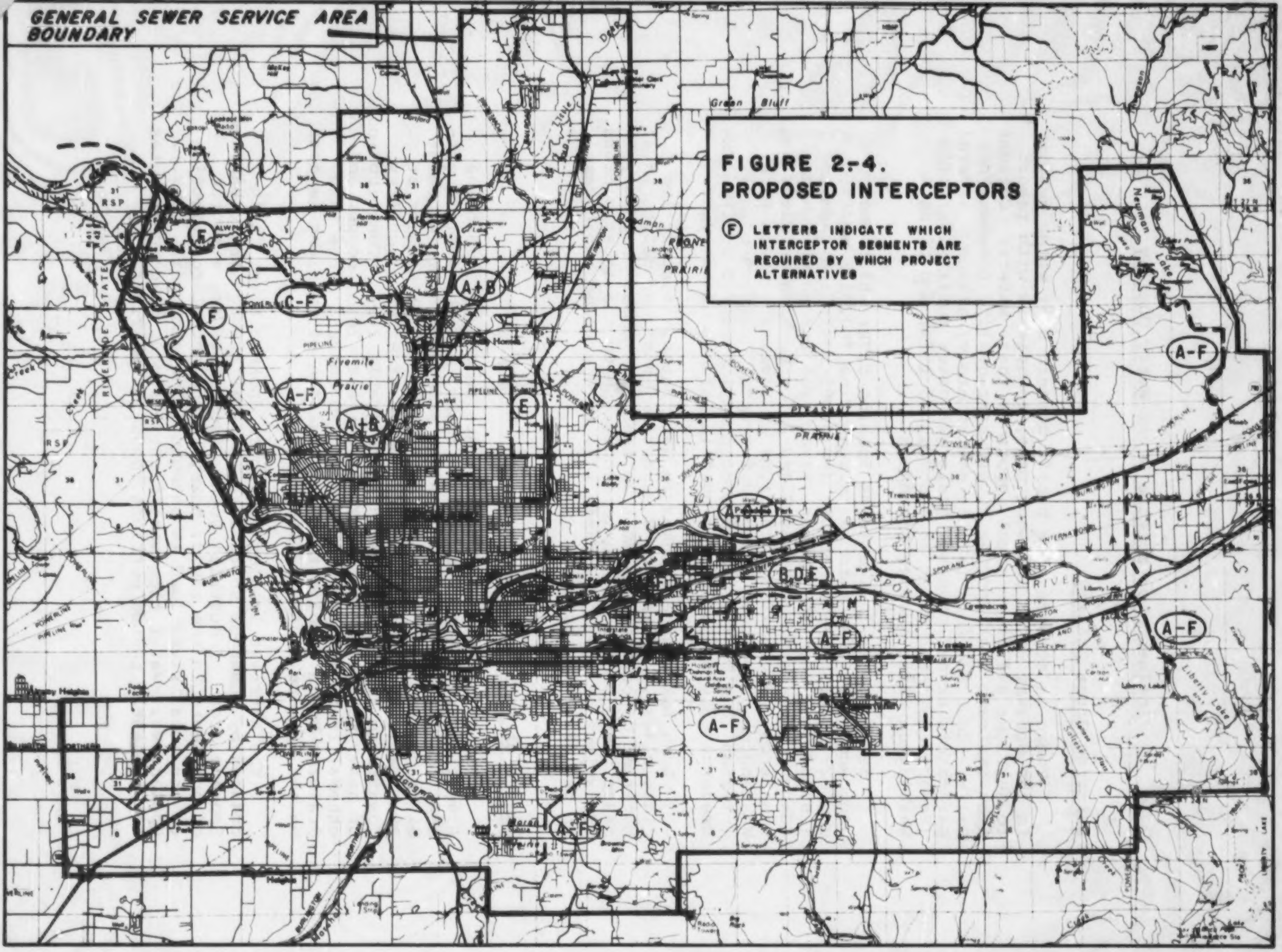


FIGURE 2-4. PROPOSED INTERCEPTORS

Influence on Spokane River Water Quality

Existing Water Quality

There is considerable public concern over water quality in the Spokane River and Long Lake, especially with regard to nutrient and trace metal inputs to these waters. Current data indicate that Spokane River water quality between Post Falls, Idaho and Long Lake is satisfactory, although several parameters exceed proposed draft EPA water quality criteria (Federal Register March 15 and July 25 1979) and Class A Washington water quality standards.

Heavy metals in the lower Spokane River which exceed proposed draft EPA criteria include zinc (>0.0145 mg/l), copper (>0.001 mg/l), mercury (>0.00008 mg/l) and cadmium (>0.00317 mg/l). The Spokane River from its mouth to the Idaho border is designed as Class A for Washington water quality standards. Since 1978, standards at Riverside State Park, Washington, have been exceeded for fecal coliform counts ($>$median 100/100 ml) and DO concentrations (<8.0 mg/l). Exceedence only occurs during certain periods of the year.

Long Lake, as all lakes in Washington, is specified "lake class". Under this designation, toxic or deleterious material concentrations must be less than those which may cause acute or chronic toxic conditions to the aquatic biota. Violations of these standards will be discussed subsequently in the fisheries section.

Source of Nutrients in the Spokane River

The major sources of pollutants in the upper Spokane River, upstream from Post Falls, Idaho, are the waste treatment facility at Coeur d'Alene and several industrial point dischargers. A U. S. Geological Survey (USGS) station at Post Falls is used to monitor Spokane River water quality downstream from Lake Coeur d'Alene (Table 2-2). Contribution of heavy metals (primarily zinc, but also lead, copper and others) from the upper reaches of the Coeur d'Alene Lake drainage basin complicate the evaluation of nutrient impacts on the Spokane River and Long Lake.

The nutrient load of the lower Spokane River is increased by numerous sources as it flows through the urbanized Spokane area. Industrial point dischargers are a source of nutrients in the river; however, the actual contribution to the total river load is unknown (Singleton pers. comm.). The Spokane wastewater treatment plant effluent also contributes significantly to the nutrient loads in the river.

Table 2-2. Monthly Mean and Range of Selected Water Quality Parameters for the Spokane River at Post Falls, Idaho, and Riverside State Park, Washington (concentrations in mg/l)

	Post Falls (River Mile 102)		Riverside State Park (River Mile 67)			
	01/75-05/79		01/74-12/77		01/78-03/79	
Parameter	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Total Phosphorus (PO_4)	0.059	0.0 -0.276	0.347	0.060-2.910	0.108	0.030-0.270
Orthophosphorus (PO_4)	0.031	0.0 -0.123	0.170	0.030-0.450	0.047	0.0 -0.120
Total Nitrogen (N)	0.249	0.030-2.300	0.873	0.220-2.360	0.832	0.270-1.850
Total Ammonia (N)	0.011	0.0 -0.050	0.263	0.050-0.600	0.098	0.0 -0.360
Un-ionized Ammonia (N)[1]	0.00003	0.0 -0.00026	0.00394	0.0013-0.036	0.00162	0.0 -0.01194
Nitrate and Nitrite (NO_3-N, NO_2-N)	0.026	0.0 -0.110	0.345	0.010-0.920	0.456	0.030-1.200
Cadmium (dissolved)[2]	0.009	0.0 -0.030	0.009	0.0 -0.020	0.001	0.0 -0.003
Copper (dissolved)[2]	0.039	0.0 -0.330	0.012	0.0 -0.030	0.004	0.0 -0.010
Lead (dissolved)[2]	0.082	0.004-0.250	0.100	0.006-0.200	-	-
Zinc (dissolved)[2]	0.196	0.090-0.675	0.168	0.045-0.475	0.093	0.009-0.210
Mercury (total)	0.00009	0.0 -0.4	0.00007	0.0 -0.0005	0.00013	0.0 -0.0008
Hardness (total)	-	19-31	-	22-92	59	24-170
Fecal Coliforms (#/100 ml)	8.7	0.0 -200	2,989	3-42,000	105	1-1,500
Dissolved O_2/% Saturation	11.1/104	7.7-13.9/ 91-125	10.9/-	8.1-14.2/-	11.1/99	7.2-15.1/79-118
Biochemical Oxygen $Demand_5$[3]	1.1	0.2-1.9	2.9	0.6-8.3	-	-

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[1] Calculated from total ammonia concentration, pH, and temperature using conversion table in Willingham (1976).

[2] Parameter recorded as "total" for Riverside State Park (01/74-12/77).

[3] BOD at Riverside State Park for 1972-1973.

SOURCE: U. S. Geological Survey, 1974-1979.

Spokane's combined sanitary and storm sewer system also adds nutrients to the river in the form of raw sewage during periods of overload. Combined sewer overflows (CSOs) usually occur in the spring due to high groundwater, snowmelt and wet weather. At Riverside State Park, a USGS station is used to monitor the water quality approximately 1 mile below the existing Spokane sewage treatment plant (STP) (Table 2-2).

Hangman Creek and the Little Spokane River are nutrient rich, but apparently have little effect on the existing nutrient levels in the Spokane River. This is primarily due to the relatively high flow of the Spokane River (Soltero et al. 1979). Recruitment from the influent aquifer is also responsible for large nitrate loads to the Spokane River according to Yake (1979).

Operation of the AWT facility in Spokane commenced on August 22, 1977, and phosphorus removal began 4 months later on December 15, 1977. By May 1978, the upgraded treatment plant was consistently achieving removal of greater than 90 percent of influent phosphorus (Yake 1979). Prior to AWT, the major source of algal nutrients to Long Lake was Spokane's primary treatment plant (Soltero et al. 1973; 1974; 1975; 1976; 1978).

Phosphorus. Extensive studies have been conducted on the phosphorus levels in the Spokane River. Total phosphorus values for November 1979 to June 1980 upstream from the Spokane STP were relatively low and uniform throughout the reach (Table 2-3). Total and orthophosphate levels at Riverside State Park below the Spokane STP have decreased significantly since phosphorus removal began at the AWT facility in late 1977 (Table 2-4). Soltero et al. (1980) determined that effluent discharges increased orthophosphate concentrations in the river during 1979 less than 3-fold. However, prior to AWT, orthophosphate concentrations in the river usually increased 13-fold following the introduction of the sewage effluent (Soltero et al. 1980).

The major source of phosphorus in Long Lake prior to AWT was the Spokane STP; however, with phosphorus removal, upstream sources now contribute a higher percentage of nutrients to the lake. Phosphorus appeared to be the growth-limiting nutrient in the euphotic zone (zone of light penetration) of Long Lake in 1978, as determined by algal assay using Selenastrum capricornutum (Soltero et al. 1979). Previous studies (Soltero et al. 1976; 1978) have shown that prior to AWT, the primary nutrient limiting phytoplankton growth was nitrogen. The recent transition to phosphorus as the primary growth-limiting nutrient may be attributed to the significant reduction in phosphorus loading to Long Lake because of AWT (Soltero et al. 1979).

Table 2-3. Monthly Mean of Selected Water Quality Parameters for the Spokane River at Stations from the Idaho/Washington State Line, to Gonzaga University, Spokane, from 11/79 to 06/80 (concentrations in mg/l)[1]

	Spokane River Stations						
Parameter	State Line[2] (96.5 RM)[3]	Harvard Bridge (92.7 RM)	Barker Bridge (90.4 RM)	Sullivan Bridge (87.8 RM)	Upriver (80.2 RM)	Greene Street (78.0 RM)	Gonzaga University (76.0 RM)
Total phosphorus (PO_4)	0.050	0.064	0.064	0.065	0.070	0.064	0.056
Total soluble and soluble reactive phosphorus (PO_4)	0.042	0.037	0.032	0.035	0.036	0.032	0.031
Total nitrogen (N)[4]	0.186	0.164	0.193	0.219	0.385	0.395	0.372
Biochemical oxygen demand$_5$	1.0	1.2	0.7	1.0	1.4	1.3	1.0
Zinc (dissolved)	0.112	0.110	0.106	0.110	0.105	0.097	0.096

[1] Funk (1980), unpublished data.
[2] Data at state line station for 11/79-03/80.
[3] Station location in river miles (RM)
[4] Data for total nitrogen for 11/79-04/80.

Table 2-4. River Loading[1] (lbs/day) of Selected Water Quality Parameters at Mean and Q_{7-10}[2] Flow for Post Falls, Idaho and Riverside State Park, Washington

Parameter	Post Falls (River Mile 102)		Riverside State Park (River Mile 67)			
	01/75-05/79		01/74-12/77		01/78-09/79	
	Mean Flow (6,690 cfs)	Q_{7-10} (113 cfs)	Mean Flow (7,570 cfs)	Q_{7-10} (560 cfs)	Mean Flow (7,570 cfs)	Q_{7-10} (560 cfs)
Total Phosphorus (PO_4)	2,127	36	14,158	1,047	4,407	326
Orthophosphorus (PO_4)	1,118	19	6,936	513	1,918	142
Total Nitrogen (N)	8,979	152	35,620	2,635	33,947	2,511
Total Ammonia (N)	397	7	10,731	794	3,999	296
Un-ionized Ammonia (N)	1	Trace	161	12	66	5
Nitrate and Nitrite (NO_3-N, NO_2-N)	938	16	14,077	1,041	18,606	1,376
Cadmium (dissolved)[3]	325	6	367	27	41	3
Copper (dissolved)[3]	1,406	24	490	36	163	12
Lead (dissolved)[3]	2,957	50	4,080	302	-	-
Zinc (dissolved)[3]	7,068	119	6,855	507	3,795	281
Mercury (total)	3	Trace	3	Trace	5	Trace

[1] Loading determined from mean monthly concentration (mg/l).

[2] 7-day, 10-year low flow.

[3] Parameter recorded as "total" for Riverside State Park, 01/74-12/77.

Yake (1979) found an inverse relationship between phosphate concentrations and flows in the lower Spokane River. Funk et al. (1973; 1975) observed two annual peaks in nutrient concentrations, one during high flow and one during low flow. High phosphate concentrations during low flows are especially critical because they occur during the prime algal growth period (August-October).

There has been an overall decline in chlorophyll a concentrations since 1978, which has been directly related to decreased phosphate loading (Soltero et al. 1979; 1980). A decreased phytoplankton biovolume was evident for most of the 1978 and 1979 growing season as a result of decreased phosphorus loading. On an annual basis, however, phytoplankton standing crop increased due to a single bloom of *Microcystis aeruginosa* in August and September (Soltero et al. 1979; 1980).

Since the initiation of AWT with phosphorus removal, Long Lake has conformed to predicted recoveries made by Gasperino and Soltero (1977), and Thomas and Soltero (1977). Blue-green algal blooms in Long Lake persist, but their association with eutrophic conditions is uncertain in view of the improvements in lake water quality (Soltero et al. 1979). Decreases in reservoir phosphorus and orthophosphorus concentrations, chlorophyll a concentrations, and primary productivity, indicate that Long Lake is reverting from a eutrophic condition to a mesotrophic condition (Soltero et al. 1979).

Nitrogen. Total nitrogen values for November 1979 to April 1980 between Post Falls and the Spokane treatment plant were generally low and gradually increased from upstream to downstream stations. Much higher total nitrogen values were found at Riverside State Park below the Spokane STP (Table 2-4). Soltero, et al. (1980) determined that in 1979 the Spokane treatment plant effluent produced a 160 percent increase in total inorganic nitrogen in the river. The mean daily inorganic nitrogen loads to Long Lake in 1978 (June through November) were not significantly different from loads before AWT at the Spokane treatment plant (Soltero et al. 1979). The Spokane River upstream from Hangman Creek appears to be the major source of nitrogen loads to Long Lake (Soltero et al. 1979).

Additional Factors Affecting Algal Growth

Recent studies indicate that algal growth in the Spokane River and Long Lake may be inhibited by the presence of heavy metals (Soltero et al. 1976; 1978; 1979). Soltero, et al. (1979) suggest that the lower heavy metal concentrations in the river, along with the change in nutrient limitation from nitrogen to phosphorus, may explain the sudden appearance of blue-green algal blooms in Long Lake in 1978. Algal assays have demonstrated that zinc inhibits the growth of Anabaena spp., but not that of Sphaerocystis schroeteri, a green algae that has often been dominant in Long Lake (Greene et al. 1978).

Zinc concentrations in the Spokane River (Table 2-3) have decreased by about 50 percent between 1973 and 1978 (Yake 1979). Zinc loading in the Spokane River (Table 2-4) decreased by 14 percent between Post Falls and Riverside State Park (Yake 1979). From November 1979 to June 1980, zinc concentrations between state line (River Mile 96.5) and Gonzaga University (River Mile 76.0) were fairly uniform but gradually decrease in a downstream direction (Table 2-3).

Nutrient Load Limitations

Phosphorus concentrations high enough to produce algae of nuisance proportions are difficult to determine and vary from one geographical area to another. A given phosphorus level may produce noxious plant growth in a lake, whereas that same level may produce no visible effects in the river which flows into that lake (EPA 1976). Total nutrient loading to a water body is more indicative of potential long-term effects than concentration increases (Vollenweider 1968). Hence, any attempt to establish single-value critical concentrations for phosphorus is inadequate (Thurston et al. 1979).

DOE, through a private consultant, is studying the existing waste loading situation in the Spokane River from the Idaho border to Long Lake. A description of existing water quality conditions and sources of waste loads is being compiled in Part 1 of the study. A methodology for allocating waste loads is also being prepared. It is intended that Part 2 of the study will aid the State of Washington in developing wastewater discharge permits for domestic and industrial discharges under the federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES) permit program. DOE must determine the most cost-effective means of treating and disposing of the Spokane area's wastewater while protecting the quality of the Spokane River, Long Lake and the Spokane Valley aquifer.

More effective wastewater treatment plans can be developed once this waste load allocation study is completed. Part 1 of the study has been completed, but the results were not available at the time of this writing. Therefore, a critical analysis of the waste load allocation plan has not been undertaken in this report.

Phase II of the DOE study is expected to develop a total maximum daily load for certain pollutants (such as phosphorus) in the river. This maximum load will establish an upper limit for constituents being discharged to the river from point sources such as the Spokane wastewater treatment plant. It is possible that the maximum load eventually recommended will be very near that which is presently discharged to the river. If that is the case, some of the wastewater alternatives being considered in the CWMP may not be possible, or may be more costly than expected. As a result, more serious consideration of alternatives to river discharge of wastewater may be necessary, or increased removal of wastewater pollutants may have to be considered in the future.

Impacts of the Proposed Alternatives on Existing Water Quality

Water quality impact analysis for each alternative (No Action, A, B, C, D, E and F) is based on the projected effluent concentrations, effluent volume and proposed outfall site(s). River volume data at Post Falls and Riverside State Park were obtained from USGS records. Loading of selected water quality parameters was calculated for mean and Q_{7-10} (lowest 7-day average flow recorded over a 10-year period) river flows.

The recording station at Post Falls (River Mile 102) was chosen because of its location upstream from all alternative discharge sites and the availability of extensive water quality data. No significant diversions or point source discharges exist between Post Falls and the Liberty Lake outfall site. The Riverside recording station is located approximately one mile downstream from the existing Spokane treatment facility and recent quality data are also available.

No-Action Alternative. This alternative would increase the existing Spokane STP effluent discharge (River Mile 67) from 31.50 MGD to 35.98 MGD in 2002. The Liberty Lake STP (River Mile 93) would discharge 2.98 MGD in 1992 and 3.4 MGD in 2002. Currently, 368 pounds per day of total phosphorus and 5,053 pounds per day of total nitrogen are discharged to the river by the existing Spokane STP. Resultant wastewater-related phosphorus (P) and nitrogen (N) load increases due to this alternative would be 18 percent in 1992 and 25 percent in 2002 (Tables 2-5 and 2-6).

This alternative proposes the continued use of septic tanks in unsewered areas, and the probable use of new septic tank systems for future development.

Table 2-5. Projected Effluent Concentration (mg/l) and Loading (lbs/day) of Selected Water Quality Parameters for Each Proposed Alternative - 1992[1]

Parameter	Concentration (mg/l)	Loading (lbs/day)[3] Alternatives A	B	C	D	E	F	No Action
Total Phosphorus (P)	1.4	580	580	538	538	433	35	433
Total nitrogen (N)	19.2	7,956	7,956	7,379	7,379	5,935	478	5,935
Total ammonia (N)	14.6	6,051	6,051	5,611	5,611	4,513	363	4,513
Un-ionized ammonia[2] (N)	0.009	3.7	3.7	3.5	3.5	2.8	0.2	2.8
Biochemical oxygen demand$_3$	21	8,702	8,702	8,071	8,071	6,492	523	6,492
Fecal coliforms (#/100 ml)	50-200	-	-	-	-	-	-	-
Chlorine	0.4	166	166	154	154	124	10	124

[1] Based on effluent quality data from Collins, Ryder, and Watkins (pers. comm.).
[2] Un-ionized ammonia (N) calculated from pH, temperature, and total ammonia using Willingham (1976).
[3] Loadings from separate treatment plants have been combined into one total.

Table 2-6. Projected Effluent Concentrations (mg/l) and Loading (lbs/day) of Selected Water Quality Parameters for Each Proposed Alternative - 2002[1]

	Concentration (mg/l)	Loading (lbs/day)[3]						
		Alternatives						
Parameter		A	B	C	D	E	F	No Action
Total phosphorus (P)	1.4	727	727	672	673	451	0.0	461
Total nitrogen (N)	19.2	9,976	9,976	9,222	9,236	6,189	0.0	6,317
Total ammonia (N)	14.6	7,586	7,586	7,012	7,023	4,706	0.0	4,803
Un-ionized ammonia[2] (N)	0.009	4.7	4.7	4.3	4.3	2.9	0.0	3.0
Biochemical oxygen demand$_5$	21	10,911	10,911	10,086	10,102	6,769	0.0	6,909
Fecal coliforms (#/100 ml)	50-100	-	-	-	-	-	-	-
Chlorine	0.4	208	208	192	192	129	0.0	132

[1] Based on effluent quality data from Collins, Ryder, and Watkins (pers. comm.).

[2] Un-ionized ammonia (N) calculated from pH, temperature, and total ammonia using Willingham (1976).

[3] Loadings from separate treatment plants have been combined into one total.

Total phosphorus loading from the Spokane waste treatment facility would increase the river load 1 percent by both 1992 and 2002 under mean flow conditions (Table 2-4). However, under Q_{7-10} conditions the Spokane River load would increase 9 percent by 1992 and 16 percent by 2002. Total phosphorus loading at the Liberty Lake outfall site would increase the river load 2 percent by 2002 under mean flow conditions and 111 percent under Q_{7-10} flow conditions (Table 2-4).

The water quality in Long Lake has improved since AWT, largely due to phosphorus reduction in the Spokane STP effluent. Long Lake is currently in a state of delicate balance and any increases in phosphorus loading to the river may have significant adverse impacts on the existing water quality (Soltero pers. comm.).

Nitrogen increases are unlikely to produce any significant effects on Long Lake water quality as long as phosphorus remains the primary limiting nutrient. The only potential adverse effects of the low volume discharge at Liberty Lake would be increased algal growth below the outfall.

Alternative A. This alternative would increase the present Spokane STP effluent discharge from 31.5 MGD to 62.19 MGD by 2002. The Liberty Lake STP would discharge 2.98 MGD in 1992 and would be abandoned by 2002. Wastewater-related P and N loads to the river would increase by 57 percent in 1992 and 99 percent in 2002 (Tables 2-5 and 2-6). The Liberty Lake STP would contribute approximately 6 percent of the total effluent load to the river by 1992.

Under mean flow conditions the Spokane treatment plant would increase river loads 4 percent by 1992 and 8 percent by 2002. River load increases under Q_{7-10} conditions would be 54 percent by 1992 and 110 percent by 2002 (Table 2-4). Spokane River load increases at Liberty Lake would be identical to the no-action alternative.

The increased phosphorus loads would stimulate algal production in Long Lake as well as in downstream impounded or slow moving waters. Soltero, et al. (1980) reported that phosphorus is currently the primary nutrient limiting algal growth in Long Lake. Nitrogen loading increases should not have any significant adverse effects on Long Lake water quality as long as phosphorus remains the limiting nutrient.

Alternative B. Alternative B would increase the existing Spokane STP effluent discharge from 31.5 MGD to 43.19 MGD in 2002. The Felts Field STP (River Mile 80) would discharge 9 MGD in 1992 and 19 MGD in 2002. The Liberty Lake STP would discharge 2.98 MGD in 1992 and would be abandoned by 2002.

The P and N load increases to the river would be identical to Alternative A; however, the effluent volume at individual outfall sites would be different (Tables 2-5 and 2-6). The Felts Field STP would contribute 18 percent of the total effluent load to the river by 1992 and 30 percent by 2002. The Liberty Lake STP would contribute 6 percent of the total sewage effluent to the river by 1992.

Effluent discharged at the Spokane treatment plant would increase Spokane River loads 2 percent by 1992 and 3 percent by 2002 under mean flow conditions. Under Q_{7-10} flow conditions the river load would be increased 22 percent by 1992 and 42 percent by 2002. The river load increases at the Liberty Lake outfall site would be identical to the previous two alternatives. At Felts Field river loads would increase 5 percent by 1992 and 10 percent by 2002 under mean flow conditions. However, river loads would increase over 600 percent by 2002 under Q_{7-10} conditions.

Resultant P loading would increase primary production in Long Lake and downstream impounded areas. Algal growth would also be enhanced immediately downstream from the outfall sites. Algal species composition may also change as a result of increased phosphorus loadings. Williams and Soltero (1978) found a distinct decrease in algal species diversity downstream from the Spokane treatment plant.

Discharge of a large percentage of the total effluent at Felts Field, 13 miles farther upstream than the no-action and Alternative A outfall sites, could possibly result in less phosphorus loading to Long Lake. Impoundments between Felts Field and Long Lake have created small reservoirs which could act as "sinks", thereby minimizing nutrient transport. More extensive research is necessary to determine the magnitude of the attenuation of transported nutrients as well as other substances.

Alternative C. This alternative proposes a 25.99 MGD discharge increase at the Spokane STP by 2002. The Liberty Lake STP would discharge 2.98 MGD in 1992 and would be abandoned by 2002. Wastewater-related P and N loads to the river would increase by 46 percent in 1992 and 82 percent in 2002 (Tables 2-5 and 2-6).

P load increases would be 15 percent less than Alternatives A and B. However, any increase in phosphorus loading to Long Lake over existing levels may adversely affect water quality (Soltero pers. comm.).

Alternative D. This alternative would increase the present Spokane STP discharge from 31.5 MGD to 38.58 MGD in 2002. The Felts Field STP would discharge 9 MGD in 1992 and 19 MGD in 2002. A discharge of 2.98 MGD is proposed at Liberty Lake in 1992.

Wastewater-related phosphorus and nitrogen loads to the river would increase by 46 percent in 1992 and 83 percent in 2002 (Tables 2-5 and 2-6). The Felts Field STP would contribute 20 percent of the effluent load in 1992 and 33 percent in 2002. Liberty Lake would contribute approximately 6 percent of the total sewage effluent to the river in 1992.

P load increases for this alternative would be the same as Alternative C. Unlike Alternative C, however, a large percentage of this load would be discharged at Felts Field rather than Spokane. Nutrient discharges farther upstream may be partially attenuated by impoundment reservoirs or removed from the river completely. From the perspective of Long Lake water quality, this alternative is superior to Alternatives A and C.

Alternative E. This alternative proposes only a 7.08 MGD increase at Spokane by 2002. The Liberty Lake treatment plant would discharge 2.98 MGD in 1992 and be abandoned by 2002. The wastewater-related P and N loads to the river would increase by 17 percent in 1992 and 22 percent in 2002.

P and N loading would be less than any of the previous alternatives. As previously stated, however, any additional loading of phosphorus to Long Lake may enhance algal productivity and consequently reduce water quality.

Alternative F. This alternative would eliminate any effluent discharge to the Spokane River from wastewater treatment plants by 2002. By 1992, the only effluent discharge to the river would be 2.98 MGD from the Liberty Lake STP. The P and N loading to the river would decrease by 91 percent in 1992 and 100 percent by 2002.

The significant decrease in P loading to the river would allow the continuance of mesotrophic conditions in Long Lake, providing, of course, that nutrient loads from other sources remain constant. Since phosphorus is the primary limiting nutrient in Long Lake a reduction in loading would indicate that a concomitant reduction in primary production would occur. The elimination of effluent discharge to the river makes this alternative the most attractive from a water quality perspective.

Mitigation Measures

The following list includes potential water quality and fishery impact mitigation measures.

Continuation of Ongoing Studies.

- DOE should establish specific loading limits for phosphorus at the three proposed wastewater discharge sites being considered in the CWMP.
- DOE should continue monitoring BOD concentrations downstream from the existing Spokane treatment plant to determine whether effluent loads are significantly affecting DO concentrations in the river and Long Lake.
- Nutrient and algal levels in Long Lake should be monitored on a regular basis.
- The various ongoing water quality studies should be continued to update the changes in parameters of concern.

Initiation of Future Studies.

- Identify the sources of phosphorus in the river not attributable to waste treatment plant discharges.
- Determine the magnitude of the attenuation of phosphorus and other compounds discharged upstream from the Spokane STP.
- Reaeration and dilution rates in the river should be calculated to enable better assessment of future discharges on water quality.
- Optimal spawning habitat for the various fish species inhabiting the river should be identified.
- Fish bioassays should be conducted using resident fish species to adequately determine acute and chronic toxicity values for heavy metals and toxins.
- The source of all toxic substances in the river should be identified.

General Measures.

- Effluent discharged into the river should be adequately diffused to alleviate any localized effects.

- If determined that metal or toxin concentrations are reducing fish productivity below acceptable levels, effluent should be disposed of on land sites or additional treatment should be required.
- If determined that phosphorus or nitrogen loading is in excess of maximum permissible levels, then effluent should be disposed of on land sites or additional treatment should be required.
- Plans should be implemented to achieve EPA proposed water quality guidelines.

Influence on Spokane River Beneficial Uses

Introduction

A wide range of beneficial uses have been identified for the Spokane River aquatic and riparian environments from the Idaho-Washington state line to Long Lake Dam. The most important water quality-dependent beneficial uses are a range of recreational activities, wildlife habitats, water supply, and aesthetic qualities. There is a marked seasonal variation in the beneficial uses. Water contact recreation activities are most intensive in the summer months, whereas other activities including fishing, rafting and irrigation occur during other specific seasons. Aesthetics is a year round river value. The following pages describe existing river uses in more detail and then relate how project-caused water quality changes could affect those uses.

Existing Water Contact Uses

Swimming and Water Skiing. Swimming and water skiing take place mainly in July and August when the water is warmest. There are three main factors which tend to determine the swimming areas: speed of river flow, access to the riverside, and the aesthetic quality of the water. The speed of the river flow limits swimming to certain sections. The upstream half of Long Lake is popular for swimming and water skiing, particularly in front of the high density housing developments and near the resorts of Tumtum and Willow Bay. In recent years, however, sewage waste, odors, and algal blooms have deferred swimming at these resorts. The most popular swimming areas are at specific sites between the Upper City Dam and the Stateline Bridge including Sullivan Park (2,500-3,000 user days per week in summer), Boulder Beach (3,000-4,000 user days per week in summer), and Mirabeau Park (1,500-

2,000 user days per week in summer) (URS Company 1980). Between Spokane and Long Lake, underwater currents, whirlpools, and cold temperatures make the river dangerous for swimming. Near the mouth of Hangman Creek and in Riverside State Park, however, the river is safe enough for wading. A City ordinance prohibits river swimming within the Spokane City limits.

Scuba Diving. The use of the river is limited for scuba diving because of the currents and whirlpools. During the summer season only 20-30 people use the river, mainly at Boulder Beach (Hickey pers. comm.).

Rafting, Canoeing, Kayaking. Most rafting occurs between June and September. The Spokane River Expeditions provide rafting runs from Glover Field (near Monroe Street) to the Rifle Club Road area (U. S. EPA 1979). Rafting courses offered at Eastern Washington University and Spokane Community College use the upper portion of the river from Post Falls downstream to Plantes Ferry (URS Company 1980). Running the river in rafts or inner tubes is a popular pastime with visitors to Riverside State Park, starting upstream from the park and ending at the riverfront campground (U. S. EPA 1979).

Canoeing on the river is limited. Approximately 15-20 members of the Eastern Washington University Recreation Department canoe near Nine Mile Dam and 35-45 people canoe in the Bowl and Pitcher area six or seven times each year (U. S. EPA 1979).

Between March and September about 40 people, mainly from the White Water Northwest Kayaking Club, use the river between Maple Street and the Fort Wright Bridge and around Bowl and Pitcher (U. S. EPA 1979). Other areas occasionally used are between Post Falls and Plantes Ferry and a few specific sites in the valley including Lyons Park, Barker Road, and at the Stateline Bridge (URS Company 1980). The river is used as a practice run for the Snake River.

Existing On-Water Recreation

Boating. From April to November under favorable weather conditions, sailboats and motor boats are used on Long Lake (U. S. EPA 1979). Upstream of Boulder Beach, limited boating occurs during the summer (URS Company 1980). Model boating activities occur on the river at the Sheraton Hotel which is used as a launching area (Spokane City Department of Public Works 1977, Appendices).

Fishing. A number of fish species are found between the Idaho/Washington border and the Long Lake Dam (refer to the section on fisheries). In Long Lake, bass fishing is a popular pastime. There are over 300 members of the bass fishing club in the Spokane area. The main season is between March and November; the most important month is May. Several "catch and release" tournaments take place annually with an average attendance of 80 members (U. S. EPA 1979). Recently the number of tournaments has declined, resulting from an increase in other fish species and the limited boat launching facilities available. Other fish species including yellow perch and crappie are caught throughout the winter, even when the lake is frozen.

Upstream from Long Lake trout predominate. The length of the season varies for different sections of the river. Above Green Road and between Mirabeau and Sullivan Parks trout can be taken from May to September; from Barker Street to the Stateline Bridge trout fly fishing occurs from May to mid-July. Annually, rainbow trout are planted between Monroe Street and Upriver Dam; rainbow and brown trout are planted between Monroe Street and Nine Mile Dam (URS Company 1980).

Ice Skating. Usually from December through February Long Lake residents enjoy ice skating on the frozen lake (U. S. EPA 1979).

Duck Hunting. The lake and river are occasionally used by waterfowl. A number of duck blinds are situated near Sportsman's Paradise, where approximately 30-50 hunters can be found on a weekend during the duck hunting season. This runs from mid-October to mid-January (U. S. EPA 1979).

Shoreline Activities

Camping and Picnicking. Riverside State Park contains 5,543 acres with a river frontage of 44,000 linear feet (U. S. EPA 1979). Within the park there are 110 sites for camping, mainly along the river. These sites are intensively used from April to October. Approximately 800,000-1,000,000 people visited the park in 1980 (Braman pers. comm.). The majority are local residents; however, approximately 50,000 Canadians visit the park annually (Spokane City Department of Public Works 1977, Appendices).

There are year-round camping facilities at the resorts of Tumtum and Willow Bay on the shores of Long Lake and at Sunset Bay there is a self-contained facility for recreational vehicles. In Spokane no camping is allowed in the City parks (Spokane City Department of Public Works 1977, Appendices).

The attractive scenery along the Spokane River provides a number of interesting areas for picnicking. In Riverside State Park and around Long Lake there are a number of riverside sites. Also, picnicking occurs adjacent to the river in the vicinity of T. J. Meenach Drive and High Bridge Park (Spokane City Department of Public Works 1977, Appendices).

Scenic Drives and Hiking. Scenic drives are not individually designated in Washington State but a number of drives of scenic beauty along rivers have been categorized by the local governments. On the east and west side of the river from the upstream end of Long Lake to the western extremity of the City of Spokane, there is the Aubrey E. L. White Drive. Drivers along this route can view the river and its canyon. Upriver Drive extends from Mission Road in the center of the City to Millwood. This also affords scenic views of the river.

Riverside State Park is a popular area for hiking. A number of the park's trails border the river.

Bird Watching. A wide variety of bird species are found in the Spokane area particularly in spring and fall. This includes a number of waterfowl. The local Audubon Society conducts a number of field trips along the river and its annual Christmas bird count includes the area around Nine Mile Falls (Warren pers. comm.).

Economic Uses

Industrial, Agricultural, and Domestic Water Withdrawals. The Kaiser-Trentwood water supply is the main industrial withdrawal from the Spokane River, amounting to 2,372 million gallons per day for consumptive use and 6,387 million gallons per day for cooling water (U. S. Army Corps of Engineers 1976, Appendix C). The consumptive use is equal to an average flow of 10 cubic feet per second (cfs) and the cooling diversion is equal to 27 cfs. For comparison, the main flow of the river is 6,927 cfs. After use, the water is returned directly to the Spokane River immediately downstream from its withdrawal point. The Defense Plant Corporation, another industrial user, has rights to 44 cfs of the river.

There are a number of other water rights applications and permits for small river withdrawals both above and below Spokane on file with the Washington Department of Ecology. The actual amount of use that is occurring, however, has not been recently investigated. Most of these applications and permits are for amounts less than 1 cfs. There are no major agricultural water withdrawals from this stretch of the Spokane River.

The Washington Water Power Company and the City of Spokane both have rights on file to divert Spokane River water for power generation. The City can divert as much as 400 cfs for power generation at the Upriver Dam generation facility. The Washington Water Power Company generates electricity at Upriver, Upper Falls, Monroe Street, Nine Mile Falls Dam, and Long Lake Dam.

Water is not taken directly from the river for domestic water uses. There are two important wells, Well Electric and Baxter Well, however, which are situated very near to the river and are used as a drinking water supply by the City. Well Electric is situated on the riverside near Felts Field. It has a total capacity of 56.4 MGD and it serves North Hill and the Low and Intermediate areas of Spokane. Baxter Well is situated at the site of the Spokane STP. It has a total capacity of 4.1 MGD and serves Low Spokane (Spokane City Water Division n.d.).

Well Electric is located at a surface height of 1,920 feet, city datum. The lowest normal groundwater depth in the well is 1,889 feet; the difference between these heights is 31 feet. Baxter Well has a surface height of 1,696 feet, its low water depth value is 1,663 feet; the difference between these heights is 33 feet. The Spokane Valley Aquifer supplies both of these wells with water. Some of the water from the river recharges the aquifer above Spokane. Therefore, if the quality of the river water declines this affects the aquifer and in turn the wells. Most of the recharge of the aquifer occurs upstream near the Washington/Idaho state border. In the case of Well Electric and Baxter Well, they are shallow enough and close enough to the river that it is possible that surface flows immediately upstream may also be of some influence.

Resorts and Restaurants. The main riverside resorts in the study area are around Long Lake. In 1975 Long Lake supported three main areas, Sportsman's Paradise, Willow Bay, and Tumtum. The former is no longer functioning. There are a number of riverside restaurants in these resorts and there are also a few which overlook the river in the City of Spokane.

Aesthetics

The scenic downriver environment of the Spokane River is characterized by fast water, steep bluffs, and relatively undisturbed flora and fauna. Portions remain in a natural state with basalt cliffs and narrow valleys.

The segment upriver from Spokane is characteristic of a pastoral stream with shallow banks and some scattered urban development. The industrial and commercial development reduces the aesthetic value.

The central river environment in the City of Spokane is typified by falls, rapids and intensive urbanization. Riverfront Park is a major aesthetic attraction in the central portion. Other scenic qualities in the City are associated with the many parks, the attractive residential neighborhoods and the architectural interest of the older homes and public buildings. The major views and vistas include Downriver Park, Bowl and Pitcher, Upriver Drive, Glover Field, Lincoln Park, and Minnehaha Park (U. S. EPA 1979).

Impacts

The most important impacts from the project will be on the recreational and domestic water supply uses of the river. The Washington State water quality standards for these beneficial uses will be described briefly before determining how each alternative will affect the beneficial uses.

Recreational Uses. To pursue recreational activities the river water must conform to three general conditions:

1) It must be reasonably free from pathogenic organisms.

2) It must not contain toxic substances which would lead to a health problem.

3) It must be aesthetically enjoyable.

The standard for these conditions depends on the type of recreational use. For contact recreation (including swimming, water skiing, and scuba diving) stricter standards are required than for shoreline activities (including camping, picnicking, and bird watching).

Pathogenic Organisms. Contamination of water by pathogenic organisms is normally monitored by testing for the presence of fecal coliform bacteria. High levels indicate the potential for a health hazard.

In Washington State, the water quality standards for water-contact recreation are the standards given for Class A and Class AA rivers. This states that fecal coliform organisms shall not exceed a median value of 100 organisms per 100 ml with not more than 10 percent of samples exceeding 200 organisms per 100 ml. For on-water contact the standards are less stringent. Fecal coliform organisms should not exceed a median value of 200 organisms per 100 ml with not more than 10 percent of samples exceeding 400 organisms per 100 ml (according to Washington water quality standards).

Toxic Substances. For in-water contact and on-water contact recreation, the Washington water quality standard states that toxic, radioactive, or deleterious material concentrations shall be below those of public health significance, or which may cause acute or chronic toxic conditions to aquatic biota, or which may adversely affect any water use.

Aesthetics. For in-water contact recreation aesthetic values shall not be impaired by the presence of materials or their effects excluding those of natural origin which offend the senses of sight, smell, touch, and taste. For on-water contact recreation, aesthetic values shall not be reduced by dissolved, suspended, floating, or submerged matter not attributed to natural causes, so as to affect water use or taint the flesh of edible species (according to Washington water quality standards).

Domestic Water Supply. The water quality standards for domestic water supply are the same as for water contact recreation (see above).

Consideration of Each Alternative. For each of the seven alternatives, a description of the changes resulting from the project will be given, followed by a brief analysis of the impacts these changes will have on the beneficial uses. In the final section, possible mitigation measures will be listed.

No-Action Alternative. This alternative would increase the 31.5-million-gallon-per-day (MGD) wastewater discharge at Spokane treatment plant to 35.98 MGD by the year 2002. At Liberty Lake there would be a river discharge of 3.4 MGD.

Water quality monitoring data for Post Falls and Riverside State Park indicate that the existing fecal coliform levels are high. At Post Falls, the range is from 0-200 organisms per 100 ml; at Riverside State Park, the range is from 1-1,500 organisms per 100 ml. At both locations the fecal coliform level exceeds the 1978 Washington state water quality standards for Class A rivers. Although the calculated average increases resulting from the plants are only 0.06 organisms per 100 ml at Liberty Lake and 0.07 organisms per 100 ml at the Spokane treatment plant, actual increases will vary with the effectiveness of disinfection, flows in the river, and water temperature. Any increase in pathogen levels is considered an adverse impact.

This fecal coliform increase will have an important impact on recreation and the quality of the domestic water supply downstream from the Liberty Lake and Spokane treatment plant outfall. Near Liberty Lake, swimming will be affected in July and August (the peak season) when the river flow is reduced and there is less dilution. The areas affected most include Harvard Road park with 200 user days per week (ud/wk) in summer, Mirabeau Park with 1,500-2,000 ud/wk, Baxter Road with 100 ud/wk, Central Valley Lyons Park with 350 ud/wk, and Sullivan Park with 2,500-3,000 ud/wk (these users are not all water-contact recreationists, but some percentage is). Downstream of the Spokane treatment plant there are no major swimming areas that will be affected. The important swimming, scuba diving, and water skiing area at Boulder Beach should not be significantly influenced.

The domestic water supply from Baxter Well and Well Electric could be influenced by the waste-related changes occurring in the river. The fecal coliform level is particularly important, but nitrates, heavy metals, and other wastewater contaminants are also of concern. The Liberty Lake discharge could affect the Well Electric water supply because the discharge is located in the upstream river stretch that is known to recharge the aquifer. The Baxter Well, although much farther downgradient, could also be affected to some degree.

At present there are signs posted in Riverside State Park campground adjacent to the river warning people not to drink the water or use it for washing. As the park is situated near the Spokane treatment plant, this illustrates that the present water is not of a high quality and any increase in fecal coliform is an indicator that the quality is declining.

In general the level of toxic substances in the river complies with the 1978 WSWQS. The level of zinc is occasionally higher than the standard. Upstream mining activity and natural sources produce these high levels. Copper and lead values during the summer months with reduced flow and low dilution occasionally exceed the standards.

The increase in toxic substances will be minimal and is not expected to reduce the important fishing potential. Although a slight increase in algal growth is expected in the vicinity of the outfalls, this should not alter the aesthetic quality of the river downstream from Liberty Lake and the Spokane treatment plant. Canoeing and kayaking, which are popular activities from Sullivan Road to Harvard Road, should not be affected. No change is expected in the shoreline activities including camping, scenic drives, and picnicking along the river shorelines of Riverside State Park.

Alternative A. For this alternative there would be no long-term discharge from Felts Field or Liberty Lake, but there would be a substantial increase of 30.69 MGD by the year 2002 from the Spokane treatment works.

The calculated average fecal coliform level would be expected to increase by 0.47 organisms per 100 ml below the Spokane plant. There would be an increase in total ammonia of 0.06 mg/l and the dissolved oxygen level would decrease slightly. These changes would affect recreational and domestic water supply downstream from the treatment plant. There would be no waste discharge upstream of Spokane; however, this is an important consideration.

The changes that would occur downstream of the Spokane plant would be similar to those for the no-action alternative but of a much greater magnitude. Certain warmwater fish species might accumulate to feed at the outfall, an advantage to some fishermen. A reduction in dissolved oxygen, however, might decrease the fish populations supported in the impounded areas above Nine Mile Dam and Long Lake Dam, reducing the size of the catch for fishermen.

The most important aspect of this alternative is the close proximity of the sewage treatment plant to Long Lake, in comparison with the other two plants being considered above Spokane. Long Lake has suffered in the past from high nutrient levels resulting in algal blooms which have had serious consequences on a wide range of on-water, in-water, and shoreline recreational activities as well as the aesthetics of the lake and its commercial uses. Of all the alternatives considered, A would have the greatest adverse impacts on the lake's beneficial uses.

Alternative B. The total waste discharge increase to the river for this alternative would be 30.69 MGD, the same as Alternative A. In this case, however, there would be an increase of 11.69 MGD at the Spokane treatment plant and 19 MGD at Felts Field. There would be no long-term discharge from the Liberty Lake site.

The impacts on the river downstream from Spokane treatment plant would be of the same variety as for Alternative A but the severity would be less. From Felts Field outfall downstream there would be an average increase in fecal coliform of 0.33 organisms per 100 ml and the dissolved oxygen level would decrease slightly.

The stretch of river immediately downstream from Felts Field is extremely important for recreational activities. At Boulder Beach, swimming, water skiing, and scuba diving are very popular. The area receives 3,000-4,000 ud/wk in the summer. Upriver Park is considered the most important City park in the Spokane area. It is situated just downstream from Felts Field. Fishing for rainbow and wild trout is important between Greene Street and Monroe Street Bridge. The aesthetic quality of the river as it flows through the residential area of East Spokane influences the attractiveness of the riverfront. There are a number of restaurants with riverfront locations along this stretch.

The severity of the impact on fishing, aesthetics, and on-water recreation are difficult to predict, because the influence is more psychological than physical. There would be a measurable impact on in-water recreation, however, including swimming, water skiing, and scuba diving, resulting from the increased fecal coliform level.

Well Electric is approximately 1 mile downstream from the proposed Felts Field plant site. This well is extremely important in supplying the City of Spokane with its domestic water. An increase in pathogens in the river at Felts Field could affect the quality of the well water, because river recharge of the aquifer is suspected in this area (Esvelt 1978). Additional study of the river-groundwater interface in this area would be needed to substantiate this impact.

The Felts Field plant site is about 24 river miles upstream from Long Lake. Therefore, only the nutrient input from a Felts Field discharge would be likely to affect the beneficial uses of the lake. The nutrient influences have been discussed in the Surface Water Quality section. Reversals in recent water quality improvements in Long Lake could adversely affect all recreational and aesthetic values of the lake.

Alternative C. For this alternative there would be a 25.99 MGD waste discharge increase at the Spokane treatment plant by the year 2002. The impacts of this would be similar to Alternative A but less severe.

Alternative D. For this alternative there would be an increase of 7.08 MGD in waste discharges at the Spokane treatment plant and 19 MGD at the Felts Field site by the year 2002. The impacts at Felts Field would be the same as Alternative B. The increase at the Spokane treatment plant would be similiar to Alternative B but less severe.

Alternative E. For this alternative the waste discharge increase would be 7.08 MGD at the City STP. This is the same increase as Alternative D. The impacts would therefore be the same.

Alternative F. There would be no increase in river waste discharges in Alternative F. Even the existing City discharge would be removed. All wastewater would be applied to the land. This alternative would have no adverse impact on the river's beneficial uses with the exception of power generation. The existing 31.5 MGD of City wastewater flow would be removed from the river. This would reduce the flows available to Washington Water Power for power generation at Nine Mile Dam and Long Lake Dam. The STP discharge represents only 0.6 percent of the river's average monthly flow. All other river uses would be affected beneficially.

Mitigation Measures. The following list includes potential beneficial use mitigation measures.

- Design wastewater outfall diffuser systems at the proposed outfall site to maximize the dilution rate at the point of discharge.
- Carefully monitor well water to detect deterioration in water quality.
- Preferentially improve certain river access points so that recreational use is discouraged near wastewater outfalls.
- Install emergency storage ponds at all treatment plant sites to increase protection from discharge of poorly treated or untreated wastewater.
- Further investigate the interchange of river and aquifer flows between the Liberty Lake STP and Well Electric.

Influence on Spokane River Fishery

Existing Fishery

The portion of the Spokane River within the study area (Long Lake Dam to the Washington/Idaho state line), contains several distinct reaches: Long Lake Reservoir (Long Lake Dam to Nine Mile Falls), Nine Mile Falls to the City Upriver Dam, and Upriver Dam to the state line.

Long Lake Reservoir primarily supports a cyprinid (northern squawfish, tench, peamouth, and chiselmouth chub) and centrarchid (largemouth bass, yellow perch, crappie, bluegill, pumpkinseed, and green sunfish) fishery (U. S. Army Corps of Engineers 1976, Appendix E). The lake is best known for its quality largemouth bass fishery. The upper portion of the lake, from the mouth of the Little Spokane River to Nine Mile Falls, supports a limited trout fishery and provides suitable spawning habitat for northern squawfish (URS Company 1980). A brief description of Long Lake fishing is presented in the EPA Environmental Impact Statement (EIS) for the City of Spokane, Combined Sewer Overflow Abatement Project (EPA 1979).

The reach of river from Nine Mile Falls to Monroe Street (falls and power dam) supports a stocked brown trout and rainbow trout fishery as well as self-sustaining populations of bass, crappie, and perch. Stocked rainbow trout occur from Monroe Street to Upriver Dam. This stretch of the river is a very popular fishing area. The portion of the river from Green Street to the Upriver Dam supports a natural rainbow trout population (one fish catch limit, season from April 20 through September 30).

A natural trout fishery also exists from the Upriver Dam to the state line. The primary sport fish in that reach is the rainbow trout; however, a population of brook trout occurs in the stretch from Trent Road to the Sullivan Street Bridge. Less common species include kokanee salmon and cutthroat trout (primarily restricted to Idaho). The entire reach of the river is suitable for fishing, with the most popular area from Harvard Road to the state line (Bailey pers. comm.).

According to Bailey (pers. comm.), rainbow trout frequently concentrate in deep pools and well oxygenated areas of the river during the low flow summer months. Over 300 rainbow trout have been counted in a single pool area.

The Washington Department of Ecology (DOE) (with Washington State University, Pullman) is conducting a study of the Spokane River fisheries from Upriver Dam to state line. The major elements of this study include population estimates, movement and migration, creel census (with Washington Water Power's assistance), food availability, and channel morphology (spawning and rearing habitat). The study began in November 1979 and will continue through December 1981. The termination date depends on the construction and operation of the Liberty Lake wastewater treatment plant (Singleton pers. comm. a).

Effect of Existing Water Quality on the Fishery

Heavy Metals. The Kellogg mining district, located along the South Fork of the Coeur d'Alene River in northern Idaho, contains major mineral deposits and is the primary source of heavy metals in the Spokane River. Mining and milling activities have discharged quantities of metals, (primarily zinc, but also lead, copper, and others) to the drainage system since ore production began in 1885. In addition to metals contributed by mine drainage water and tailings leachate, metals are discharged by a large lead smelter located near Kellogg, Idaho, and an electrolyte zinc plant which reduces ore and ore concentrates to refined metals ready for market (Yake 1979).

In the early 1970s, state and federal regulatory agencies initiated programs to reduce heavy metal input to the Coeur d'Alene and Spokane River drainage basin. Nonetheless, significant quantities of heavy metals continue to leach into the Coeur d'Alene and subsequently the Spokane River. Extensive research has been conducted on the sources and effects of heavy metals in the drainage systems, and has been published in works by Ellis (1970), Mink et al. (1971), Savage and Rabe (1973), Funk et al. (1973; 1975), Maxfield et al. (1974), Sheppard and Funk (1975), and Yake (1977).

The toxic effects of these elements on fish depend on a variety of environmental factors, including dissolved oxygen concentration, pH, temperature, water hardness, and the fish species itself (U. S. EPA 1976). An increase in water temperature along with the concomitant reduction in dissolved oxygen solubility increases heavy metal toxicity, especially to the more susceptible trout and salmon species (American Fisheries Society 1979). Increased temperatures accelerate metabolic processes and the rate of gill irrigation. Consequently, fish are usually killed more rapidly at moderately elevated temperatures than at lower temperatures. Reduced dissolved oxygen concentrations require increased irrigation of respiratory surfaces. This brings to these surfaces a larger quantity of any toxin present in the water. Consequently, the summer periods characterized by low flows and increased temperatures represent the time of year with the greatest potential for adverse effects on the Spokane River fishery.

Water hardness is also another factor which affects the toxicity of heavy metals on fish. Hardness is the measure of the concentration of polyvalent metallic ions dissolved in the water, principally calcium and magnesium (U. S. EPA 1976). The calcium and magnesium ions complex with the heavy metals producing a compound less toxic to fish. With some metals such as cadmium, a truly antagonistic reaction occurs in "hard" waters which inhibits uptake of metals by fish (Davies 1976). Thus, heavy metal toxicity is generally more severe in "softer" waters. Ion concentrations in the Spokane River vary from 0-50 mg/l CA CO_3; values in this range are indicative of "soft" waters (U. S. EPA 1976).

Zinc. Mean zinc concentrations are 0.196 mg/l at Post Falls, Idaho and 0.093 at Riverside State Park, Washington (Table 2-2). Both concentrations exceed recommended criteria for protection of freshwater species. The American Fisheries Society (1979) suggests a safe concentration of 0.050 mg/l in a hardness range of 0-75 mg/l $CaCO_3$. Whereas, U. S. EPA (1976) recommends a concentration which does not exceed 0.01 the 96 LC_{50} value (96-hour, 50 percent mortality concentration) as determined through bioassay using a sensitive resident species. The 96 LC_{50} values for rainbow trout are reported to be 0.43 mg/l (26 mg/l $CaCO_3$) (Sinley et al. 1974). Values for the much more tolerant bluegill and sunfish species exceed 15.0 mg/l (Cairns et al. 1971).

Funk et al. (1975) state that zinc levels in muscle tissues of fish in the Spokane River may be 2-3 times that of the same species of fish from unpolluted streams high in the Coeur d'Alene drainage. The exceedence of safety criteria by existing zinc concentrations indicates that either resident fish have acclimated to high zinc concentrations or measurement of zinc includes a form nontoxic to fish.

Cadmium. Mean concentrations at Post Falls and Riverside are <0.009 mg/l and 0.001 mg/l, respectively (Table 2-2). Recommended criteria for salmonid fishes in soft water (35-75 mg/l $CaCO_3$) is 0.001 mg/l; 0.002 mg/l for less sensitive freshwater species (American Fisheries Society 1979). These concentrations are barely exceeded by existing river concentrations and do not present a significant impairment to continued fish productivity. From a practical perspective, measurement of cadmium as well as other heavy metals is imprecise at such low concentrations and should be viewed only as an estimate of existing conditions.

Copper. Mean concentrations of copper in the Spokane River are 0.039 mg/l at Post Falls and 0.004 mg/l at Riverside (Table 2-2). Once again, heavy metal concentrations are lower at the downstream station. Recommended criteria for protection of freshwater life is 0.01 times the 96 LC_{50} value determined through nonaerated bioassay using a sensitive resident species (U. S. EPA 1976). McKim and Benoit (1971) reported that the 96 LC_{50} value is 0.1 mg/l for brook trout (45 mg/l $CaCO_3$) and 0.77 mg/l for bluegill (46 mg/l $CaCO_3$). Safety criteria are thus exceeded for both fish species at Post Falls, but only slightly exceeded for the former species and not at all for the latter at Riverside.

Lead. Mean lead concentrations are 0.032 mg/l at Post Falls and <0.100 mg/l at Riverside (Table 2-2). The American Fisheries Society (1979) recommends a safety criteria of 0.025 mg/l (30-100 mg/l $CaCO_3$) whereas, Davies and Goettl

(1977) suggest a much more restrictive criteria of 0.010 mg/l (35-75 mg/l $CaCO_3$). Both values are exceeded by Spokane River concentrations at Post Falls and Riverside.

Mercury. Recommended criteria for the protection of freshwater aquatic life and wildlife is 0.00005 mg/l (U. S. EPA 1976). The degree of toxicity is strongly dependent on the mercury compounds present. Mercury exists in several aqueous forms, hence the U. S. EPA (1976) criteria represent a compromise value. Mean mercury concentrations are 0.00009 mg/l at Post Falls and .00013 mg/l at Riverside (Table 2-2). Both concentrations exceed recommended safety criteria; however, due to the practical limitations of measurement at these low concentrations and the magnitude of the violation, significant impairment of adult fish productivity is doubtful.

Toxic Substances.

Chlorine. Chlorine is highly soluble and reacts readily with many inorganic substances and all plant and animal tissues. The denaturing effect of chlorine on animal and plant tissue forms the basis for its use as an effective water or wastewater disinfectant. Recommended criteria are 0.002 mg/l for salmonid fish and 0.01 mg/l for other freshwater organisms (U. S. EPA 1976).

Credible data for chlorine concentrations in the Spokane River do not exist, hence comparison with safety criteria is not possible. The primary source of chlorine in the study area is the existing treatment plants at Coeur d'Alene, Idaho and Spokane, Washington. The Post Falls facility discharges approximately 9 pounds of chlorine per day which, under mean flow conditions, results in a 0.001 mg/l river concentration increase at the outfall site. The Spokane treatment plant discharges approximately 105 pounds per day which, under mean flow conditions, results in a 0.0026 mg/l increase in the receiving water. Safety criteria are thus barely exceeded at both locations, provided of course that these two treatment facilities are the only major sources of chlorine in the river.

Un-ionized Ammonia. The un-ionized form of ammonia (NH_3) is generally recognized as the molecule toxic to fish (Willingham 1976). It exists in equilibrium with ionized ammonia (NH_4). Because of this relationship, the concentration of un-ionized ammonia is affected by pH, temperature, hardness, and the total ammonia concentration (U. S. EPA 1976). Suggested criteria are 0.02 mg/l for salmonids and 0.10 mg/l for other freshwater species (American Fisheries

Society 1979). Existing Spokane River concentrations are considerably below these values at both Post Falls and Riverside State Park (Table 2-2).

Factors Affecting Dissolved Oxygen Concentrations. Dissolved oxygen concentrations at Post Falls range from 7.7-13.9 mg/l with a mean of 11.1 mg/l and percent saturation varies from 91-125 percent with a mean value of 104 percent. Dissolved oxygen concentrations and percent saturation at Riverside range from 7.2-15.1 mg/l (mean of 11.1 mg/l) and 79-118 percent (mean of 99 percent), respectively (Table 2-2). The minimum dissolved oxygen concentration necessary to maintain good fish populations is 5.0 mg/l (American Fisheries Society 1979). Recommended criteria for salmonid spawning beds is also 5.0 mg/l in the interstitial water of the gravel (U. S. EPA 1976). Recorded concentrations in the Spokane River do not fall below this value below Post Falls Dam. Washington Class A water quality standards, however, require that freshwater dissolved oxygen concentrations shall exceed 8.0 mg/l.

Dissolved oxygen concentrations in Long Lake, however, violate suggested criteria and state standards during certain times of the year. An annual cycle of dissolved oxygen fluctuations was presented by Soltero et al. (1979). Dissolved oxygen concentrations exceeded 7.0 mg/l throughout the water column during May and June. With the development of thermal stratification in July, dissolved oxygen in the hypolimnion (the lower layer of water in a thermally stratified lake) began to decline. Hypolimnetic stagnation reached a maximum in mid-August with dissolved oxygen less than 1.0 mg/l. The greatest dissolved oxygen differential between surface and bottom waters was 11.2 mg/l in August. With the loss of thermal stratification in September, surface and bottom waters began to mix. By mid-October, dissolved oxygen concentrations again exceeded 7.0 mg/l throughout the reservoir.

The BOD_5 (biological oxygen demand) and total ammonia are two primary factors which contribute to the deoxygenation of receiving waters. BOD_5 represents the measure of the quantity of dissolved oxygen necessary for the decomposition of organic matter by microorganisms such as bacteria. In oxygenated natural water systems, ammonia is rapidly oxidized to nitrite (NO_2) which is then oxidized into nitrate (NO_3). The rate at which ammonia is oxidized to nitrite and ultimately, nitrate is highly dependent on environmental conditions. Unlike carbonaceous BOD, which is generally oxidized by a spectrum of heterotrophic (non-self nourishing) bacteria in the water column, ammonia is oxidized by a few specialized genera of bacteria. These nitrifiers are typically found attached to substrate. Therefore, the nitrification rate is a function of river bottom area, water volume ratios, as well as substrate types (Yake 1976).

Mean BOD_5 concentrations are 1.10 mg/l at Post Falls and 2.98 mg/l at Riverside. Mean ammonia concentrations at Post Falls and Riverside are 0.011 mg/l and 0.098 mg/l, respectively (Table 2-2). Generally, minimum concentrations for the protection of freshwater life are not recommended for BOD_5 and total ammonia. Safety criteria are suggested for DO instead. Maximum allowable BOD_5 and ammonia loads are then based on that particular DO concentration, the volume of the effluent discharge, and the volume of the receiving water. Loading of BOD_5 and ammonia to the Spokane River is currently below levels necessary to produce oxygen concentrations capable of significantly reducing adult fish productivity.

Impact of the Proposed Alternatives on the Existing Fishery

Mean concentration increases of selected water quality parameters due to each alternative were calculated by dividing the combined river and effluent load by their respective total volumes (Table 2-7). Resultant concentration increases are at the point of effluent discharge and do not represent cumulative values for those alternatives with several outfall locations.

No Action Alternative. This alternative would increase the 31.5 million gallon per day (MGD) discharge at the Spokane treatment plant to 34.02 MGD in 1992. Another 1.96 MGD increase is proposed by 2002. No discharge is proposed at Felts Field in either 1992 or 2002. At Liberty Lake, discharge would be 2.98 MGD in 1992 and 3.4 MGD in 2002.

Heavy Metal Increases. Increases (<.001 mg/l) of all heavy metals would occur at all outfall sites by 1992 and 2002 (Tables 2-7 and 2-8). This is primarily due to the low effluent volume-to-high-river-volume ratio. The salmonid fish species are generally much more susceptible to heavy metals and toxins in comparison to the warmwater species (bass, sunfish, bluegill). Nevertheless, adult fish productivity should not be significantly impaired beyond existing levels by the resultant concentration increases. A properly diffused effluent should minimize any localized effects below the outfall.

Trace increases may, however, potentially affect non-adult fish. Mortality due to heavy metals is generally more severe in the embryonic and fry stages (EPA 1976). The 96 LC_{50} value for fry of cutthroat trout has been reported to be as low as 0.09 mg/l zinc (Rabe and Sappington 1970) and 0.1 mg/l zinc for chinook salmon (Chopman n.d.). The recommended safety criteria of .01 times the LC_{50} is thus greatly exceeded by Spokane River concentrations at both

Table 2-7. Expected Pollutant Concentration Increases in the Spokane River at the Point of Effluent Discharge Due to Each Proposed Alternative - 1992 Wastewater Flows (mg/l)[6]

	Liberty Lake[3]							Felts Field[3]							City of Spokane[4]						
		Alternative							Alternative							Alternative					
Parameter	No Action	A	B	C	D	E	F	No Action	A	B	C	D	E	F	No Action	A	B	C	D	E	F
Total Ammonia[2]	0.01	0.01	0.01	0.01	0.01	0.01	0.01			0.03		0.03			0.01	0.05	0.02	0.03	0.01	0.01	
Un-ionized Ammonia[2]	Trace[5]	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
BOD_5	0.01	0.01	0.01	0.01	0.01	0.01	0.01			0.04		0.04			0.01	0.07	0.03	0.05	0.01	0.01	
Chlorine[2]	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Cadmium[1]	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Copper[1]	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Lead	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Mercury[1]	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Zinc[1]	Trace	Trace	Trace	Trace	Trace	Trace	Trace			Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	

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[1] Washington Department of Ecology (1980a).

[2] Collins, Ryder, and Watkins (pers. comm. a).

[3] Based on USGS flow data recorded at Post Falls, Idaho 1975-1979.

[4] Based on USGS flow data recorded at Riverside State Park, Washington 1978-1979.

[5] Trace - less than 0.001 mg/l.

[6] Concentration increases due to alternatives with multiple discharge locations are noncumulative.

Table 2-8. Expected Pollutant Concentration Increases in the Spokane River at the Point of Effluent Discharge Due to Each Proposed Alternative - 2002 Wastewater Flows (mg/l)[6]

	Liberty Lake[3]							Felts Field[3]							City of Spokane[4]						
	Alternative							Alternative							Alternative						
Parameter	No Action	A	B	C	D	E	F	No Action	A	B	C	D	E	F	No Action	A	B	C	D	E	F
Total Ammonia[2]	0.01									0.06		0.06			0.01	0.09	0.03	0.08	0.02	0.02	
Un-ionized Ammonia[2]	Trace[5]									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
BOD_5[2]	0.02									0.09		0.09			0.02	0.13	0.05	0.11	0.03	0.03	
Chlorine[2]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Cadmium[1]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Copper[1]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Lead[1]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Mercury[1]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	
Zinc[1]	Trace									Trace		Trace			Trace	Trace	Trace	Trace	Trace	Trace	

[1] Washington Department of Ecology (1980a).

[2] Collins, Ryder, and Watkins (pers. comm. a).

[3] Based on USGS flow data recorded at Post Falls, Idaho 1975-1979.

[4] Based on USGS flow data recorded at Riverside State Park, Washington 1978-1979.

[5] Trace - less than 0.001 mg/l.

[6] Concentration increases due to alternatives with multiple discharge locations are noncumulative.

Post Falls and Riverside. Both copper and lead concentrations also exceed recommended criteria for the protection of freshwater fish. Ninety-six LC_{50} values for brook trout fingerlings in soft water are approximately 0.1 mg/l copper, with chinook salmon as low as 0.2 mg/l copper. Five-week post-hatch coho salmon 96 LC_{50} values for lead are 0.8 mg/l (McKim and Benoit 1971). These results indicate that although adult fish productivity should not be significantly impaired below existing levels by the trace metal increases, the possibility of increased egg and fry mortality is conceivable.

Toxic Substances. Concentration increases of residual chlorine and un-ionized ammonia are less than 0.001 mg/l (trace) at all projected outfall sites. Adult fish are able to detect low concentrations of these substances and would simply avoid areas immediately downstream from the outfall site (U. S. EPA 1976). A properly diffused effluent should mitigate any adverse effects on adult fish productivity.

Embryonic and larval stages, in contrast, are generally restricted to a particular area in the river. Consequently, an outfall site placed immediately upstream from optimal spawning habitat may ultimately reduce fish productivity. Brungs (1973) reported that residual chlorine concentrations as low as .006 mg/l were lethal to trout fry in only two days. The 96 LC_{50} value of un-ionized ammonia for trout spawn is 0.25-0.33 mg/l (Wuhrmann and Woker 1948).

Dissolved Oxygen Decreases. Mean river BOD_5 concentration increases at the Spokane outfall site would be 0.01 mg/l (< 1 percent increase) in 1992 and 0.02 mg/l (< 1 percent increase) in 2002 (Tables 2-7 and 2-8). River concentration increases at Liberty Lake in 1992 would be less than 2 percent. Total ammonia increases at Spokane would be .01 mg/l (10 percent in both 1992 and 2002. Liberty Lake concentration increases in 1992 and 2002 would exceed 90 percent; however, due to the low background levels, this would result in only a 0.01 mg/l increase to the river.

The deoxygenation rate of the waste material, the reaeration rate of the river, and the dilution ratio must be determined to adequately assess the impacts of increased BOD_5 and total ammonia loads. Inadequate data prevent accurate calculation of these parameters. Therefore, conclusions concerning BOD_5 and ammonia are speculative. McKee and Wolf (1963) stated that a 5 mg/l BOD increase in a small sluggish stream might be sufficient to produce deoxygenation resulting in anaerobic conditions, whereas a swift mountain stream could handle 50 mg/l without appreciable depletion of DO. The study area within the Spokane River is obviously between these two extremes; however, the width, depth, mean current velocity and high oxygen to BOD, ammonia ratio indicate that no significant reduction in DO should occur in the flowing portions of the river.

Fish embryonic and larval stages are especially vulnerable to decreased DO concentrations because their ability to extract oxygen from the water is not fully developed, and they cannot move away from adverse conditions (U. S. EPA 1976). This is especially true of the salmonids which bury their fertilized eggs in gravel. The flow through gravel is often slow, especially if siltation has occurred. If it is slow enough, the developing fish and other benthic organisms can easily deplete the oxygen supply enough to cause damage, especially if the concentration in the water is relatively low before it enters the gravel (Cooper 1965).

Embryonic and larval forms restricted to the flowing portions of the river should not be subjected to significantly decreased DO concentrations. However, DO concentrations in slow-flowing or impounded areas, such as upstream from Nine Mile Dam, may be reduced below existing levels due to increased BOD_5 and ammonia loads. Adult fish, repelled by low oxygen concentrations, particularly at high temperatures, can simply avoid these areas (Jones 1952). Embryonic and larval stages, in contrast, cannot usually move away.

The effects of upstream increases in BOD_5 and total ammonia on Long Lake is another area of extreme uncertainty. Cunningham and Pine (1969) and Soltero (pers. comm.) suggest that the BOD carried by the river is essentially exerted before entering Long Lake. The anaerobic condition of the lake is the result primarily of plankton decomposition within the lake itself. Cunningham and Pine (1969) found a high positive correlation between the quantity of volatile sediments and the DO concentrations in the overlying water. A study presently being conducted downstream from the current Spokane treatment plant by the Washington DOE should substantiate these conclusions (Yake pers. comm.).

The warmwater fish species (bluegill, sunfish, crappie, bass and perch) inhabiting the lake are capable of surviving in waters with DO concentrations of less than 3.0 mg/l (Moyle 1976). They feed in a variety of locations within a lake, including shallow water, on the bottom, in midwater aquatic vegetation and on the surface. All species generally spawn in shallow waters 1-3 meters deep. The northern squawfish is an exception, as it usually spawns in groups at depths of approximately 12 meters (Patten and Rodman 1969). Therefore, even if upstream BOD_5 and ammonia loads contribute to the deoxygenation of the deeper waters at Long Lake, resident fish species productivity probably would not be impaired.

Alternative A. Alternative A proposes a 12.6 MGD wastewater discharge increase in 1992 and a 30.69 MGD increase in 2002 at the Spokane treatment facility. There would be no effluent discharge at Felts Field and a 2.98 MGD discharge in 1992 at Liberty Lake. The differences between Alternative A and the No-Action Alternative are (1) a 37 percent effluent discharge increase in 1992 and a 73 percent effluent discharge increase in 2002 at the Spokane facility, and (2) the absence of a discharge at Liberty Lake in 2002.

Heavy metal and toxin increases at Spokane would be in trace amounts and should produce effects similar to those previously mentioned for the No-Action Alternative. BOD_5 concentration increases in the river at the Spokane outfall site would be 0.07 mg/l in 1992 and 0.13 mg/l in 2002 (Tables 2-7 and 2-8). Total ammonia concentration increases would be 0.05 mg/l in 1992 and 0.09 mg/l in 2002 (Tables 2-7 and 2-8). These increases should not significantly impair fish productivity in the river and downstream in Long Lake. Without more extensive data, however, this conclusion is speculative.

The absence of an effluent discharge at Liberty Lake in 2002 would eliminate localized effects of heavy metals and toxins on resident fish species. A popular fishing locale exists between Harvard Road and the Stateline, and a brook trout fishery exists between Trent and Sullivan Roads. Fish productivity in these areas would therefore remain at present levels. Any potential dissolved oxygen decreases at downstream slow-moving or impounded areas would likewise be eliminated.

Alternative B. This alternative proposes a much smaller effluent increase at the Spokane plant in comparison to Alternative A. A 6.12 MGD increase would occur in 1992 and an 11.69 MGD increase would occur in 2002. Discharge in the Spokane River at Liberty Lake would be identical with Alternative A and would have the same effects on fish productivity. The major difference between Alternative B and the previous two alternatives is that a 9 mgd discharge is proposed at Felts Field in 1992 and a 19 MGD discharge is expected by 2002.

As effluent discharge to the river at the Spokane facility would be less than Alternative A, the deleterious effects of heavy metals would be proportionally reduced. The proposed discharge at Felts Field is immediately upstream from a popular fishing spot between Green Street and the Monroe Street Bridge. Rainbow trout are stocked in an area approximately two miles downstream from the outfall site. Heavy metal and toxin increases in both 1992 and 2002, however, would be in trace amounts and should not significantly reduce adult fish productivity.

By discharging a significant proportion of the total effluent at Felts Field, 13 miles upstream from the Alternative A and No-Action Alternative outfall sites, effects on the Long Lake and lower Spokane River fisheries may be reduced. The small reservoirs created by impoundments downstream from Felts Field may act as "sinks" thereby restricting downstream transport of heavy metals and toxins. The Spokane Dam located just downstream from the outfall site has an estimated storage of 1,500 acre-feet. Active storage at the Upper Falls Dam, about 4 miles downstream, is 800 acre-feet, whereas storage at the Monroe Street Dam is 70 acre-feet, and probably negligible. Impoundment storage at the Nine Mile Dam between low pool (1,590.6 feet) and maximum pool (1,606.6 feet) is 4,600 acre-feet.

Yake (pers. comm.) states that the mechanisms are definitely present and that these reservoirs could be areas where metals or toxins settle out. Concentrations of dissolved zinc gradually decrease at several sampling stations from the stateline downstream to Gonzaga University (Table 2-3). These results tentatively indicate that attenuation of certain heavy metals and toxins may occur due to impoundment structures. Actual removal of heavy metals and toxins from the river by various biological pathways and conversion to non-toxic forms may also contribute to the downstream decrease in concentrations.

Resultant BOD_5 concentrations in the river would be 0.04 mg/l in 1992 and 0.06 mg/l in 2002. Ammonia concentration increases would be 0.03 mg/l in 1992 and 0.09 mg/l in 2002. These relatively small concentration increases indicate that no significant deoxygenation will occur in the flowing portions of the river. Depending on the amount of dead storage upstream from the aforementioned impoundments, slight deoxygenation is conceivable in these areas, primarily in the deeper waters. However, both salmonid and warmwater fish species occurring in the Spokane River spawn in shallow waters (Moyle 1976). Therefore, significantly decreased productivity of the embryo and fry stages is unlikely.

The adverse effects of increased BOD_5 and ammonia loads on the Long Lake fishery probably would not be significant. The width, depth and current velocity of the river between the Felts Field and Spokane outfall sites indicate that a greater degree of reaeration would occur in comparison to the previous two alternatives. Impoundments may conceivably attenuate BOD_5 and total ammonia loads, although data from selected river stations do not substantiate this conclusion (Table 2-3).

From a fisheries perspective, Alternative B is superior to Alternative A, as any adverse effects on Lower Spokane River and/or Long Lake fish productivity would be eliminated or reduced in severity.

Alternative C. Alternative C proposes an 11.52 MGD increase at the Spokane treatment facility in 1992 and a 25.99 MGD increase in 2002. No effluent would be discharged at Felts Field, and a 2.98 MGD discharge is proposed for Liberty Lake in 1992. This alternative is similar to Alternative A with the only significant difference being an 8 percent effluent volume reduction at the Spokane City plant.

Heavy metal and toxin concentration increases would again be in trace amounts (Table 2-7). BOD_5 concentrations in the receiving water would be 0.05 mg/l in 1992 and 0.11 mg/l in 2002 as compared to 0.07 mg/l and 0.13 mg/l for Alternative A (Tables 2-7 and 2-8). Total ammonia concentration increases would be 0.03 mg/l in 1992 and 0.08 mg/l in 2002. In contrast, Alternative A increases would be 0.05 mg/l in 1992 and 0.09 mg/l in 2002. Alternative C is therefore slightly more advantageous than Alternative A as concentration increases below the Spokane treatment plant outfall would be less. This decrease would reduce the potential for adverse localized effects on embryonic and juvenile fish. This alternative, however, is less desirable than Alternative B as the effluent is discharged 13 miles farther downstream, which presents a greater potential for adverse effects on the Long Lake fishery.

Alternative D. This alternative proposes a 2.52 MGD increase over present levels at the Spokane plant in 1992 and a 7.08 MGD increase in 2002. The Liberty Lake discharge would be 2.98 MGD in 1992 and nonexistent in 2002. Alternative D is similar to Alternative B in that a 9.0 MGD discharge is proposed at Felts Field in 1992 and a 19.0 MGD discharge is expected in 2002. The only significant difference is a 10 percent reduction in effluent discharge to the Spokane River at the Spokane outfall site. Therefore, resultant concentration increases would be identical to Alternative B at the Felts Field and Liberty Lake sites. The smaller increases at Spokane would reduce any localized effects on downstream fish productivity as well as minimize possible impacts on the Long Lake fishery.

Alternative E. Alternative E proposes a 2.52 MGD increase at Spokane in 1992 and a 7.08 MGD increase in 2002. The only other planned discharge is 2.98 MGD at Liberty Lake in 1992. This alternative resembles Alternatives A and C in that no effluent discharge is proposed at Felts Field. The only major difference is a reduction at the Spokane treatment facility.

Resultant concentration increases in BOD_5 would be 0.01 mg/l in 1992 and 0.03 mg/l in 2002 (Tables 2-7 and 2-8). Total ammonia increases would be 0.01 mg/l in 1992 and 0.02

mg/l in 2002 (Tables 2-7 and 2-8). Once again, heavy metal and toxin increases would be in trace amounts. These reduced concentration increases at the Spokane treatment plant and the absence of discharge at Felts Field make this alternative more attractive than the previously discussed alternatives.

Alternative F. This alternative eliminates all wastewater discharge from the study area except for a 2.98 MGD discharge in 1992 at Liberty Lake. From a fisheries perspective, this alternative is superior to the previous ones. Concentration increases of BOD_5 and total ammonia would only be 0.01 mg/l at Liberty Lake in 1992 and nonexistent in 2002. The only potential adverse impacts of this alternative would be on fish inhabiting areas immediately downstream from the Liberty Lake outfall site.

Impact on the Spokane Valley Aquifer

Introduction

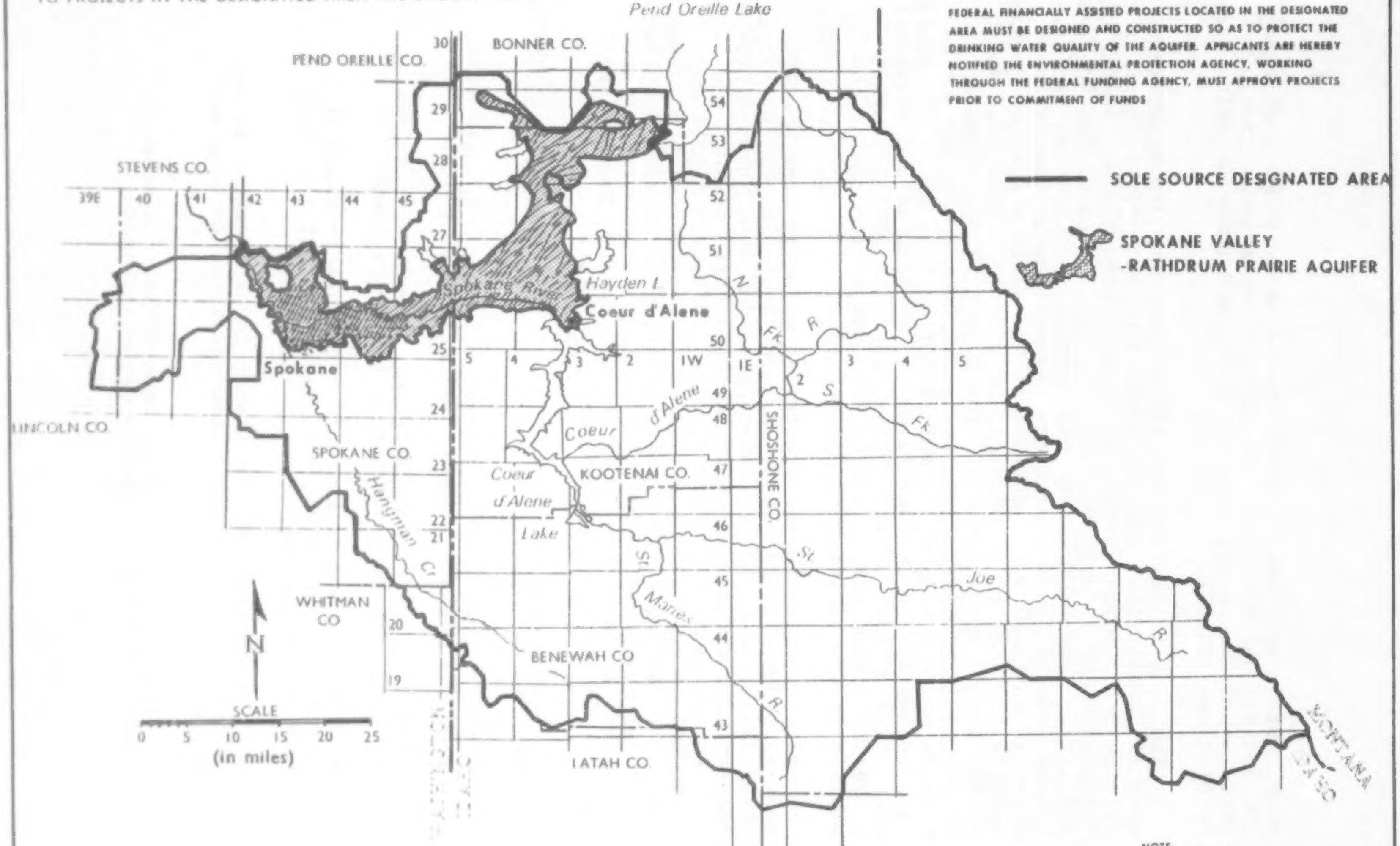
The effect of the proposed Spokane County CWMP on the Spokane Valley Aquifer (Figure 2-5) is one of the major environmental issues of this project. This is due primarily to the aquifer's status as a designated "sole source" of water supply. EPA made this designation under authority of the federal Safe Drinking Water Act in February 1978. As of 1976 the aquifer was being used as a water source by about 338,000 people in northern Idaho and eastern Washington (Drost and Seitz 1978).

Character of the Aquifer

The Spokane Valley-Rathdrum Prairie Aquifer was studied in detail over the past 4 years. The most comprehensive physical description was prepared by Drost and Seitz (1978) for the USGS. This report should be referred to for a complete description of the aquifer's character. In general, the aquifer is composed of unconsolidated glaciofluvial deposits covering an area of about 350 square miles, stretching from Pend Oreille Lake, Idaho on the north to the confluence of the Spokane and Little Spokane Rivers west of Spokane, Washington. Both the surface soils and the underlying deposits are extremely porous and are capable of rapidly transmitting water. The underground water body flows southerly then westerly at a rate of up to 64 feet per day and lies from 40-400 feet below the surface. The total recharge and discharge of the aquifer is estimated to be 1,320 cfs (Drost and Seitz 1978). The present water quality of the aquifer is described as

(1) COMMENTS (WITH SUPPORTING DOCUMENTATION) APPLICABLE TO PROJECTS IN THE DESIGNATED AREA ARE ENCOURAGED.

FEDERAL FINANCIALLY ASSISTED PROJECTS LOCATED IN THE DESIGNATED AREA MUST BE DESIGNED AND CONSTRUCTED SO AS TO PROTECT THE DRINKING WATER QUALITY OF THE AQUIFER. APPLICANTS ARE HEREBY NOTIFIED THE ENVIRONMENTAL PROTECTION AGENCY, WORKING THROUGH THE FEDERAL FUNDING AGENCY, MUST APPROVE PROJECTS PRIOR TO COMMITMENT OF FUNDS



NOTE
DESIGNATED UNDER THE AUTHORITY OF SECTION 1424(e) OF THE SAFE DRINKING WATER ACT (PL 93-523)
(FEDERAL REGISTER, VOL 43, NO 28-THURSDAY FEBRUARY 9, 1978)

FIGURE 2-5
SOLE SOURCE AREA FOR THE SPOKANE VALLEY—RATHDRUM PRAIRIE AQUIFER

EPA

good, with a very small percentage of water samples showing contaminants in excess of the maximum contaminant levels (MCLs) included in the National Interim Primary Drinking Water Regulations (NIPDWR; 40 CFR 141).

The City of Spokane and the surrounding County urban area is located over the westernmost portion of the aquifer (Figure 2-5). The groundwater in this area flows westerly out of Idaho and then northerly toward the confluence of the Spokane and Little Spokane Rivers. The depth to groundwater varies, but is generally 120 feet below the surface at the state line, 40 feet below the surface at the eastern edge of Spokane, and 100-150 feet below the surface of the uplands just south of the Little Spokane River. The Spokane River loses water to the aquifer between Post Falls, Idaho and the Greenacres area of Spokane Valley. Downstream from this point the aquifer is normally adding surface flows to the Spokane and eventually the Little Spokane Rivers (Drost and Seitz 1978). Esvelt (1978) indicates there is also some river recharge of the aquifer in the vicinity of Upriver Dam.

Water quality in the aquifer is rated as good. USGS, Spokane County (Esvelt 1978) and the Panhandle Health District (PHD) (1977) have all published data from major groundwater quality monitoring studies in the last three years. The extensive monitoring effort reported in Esvelt (1978) was conducted under a 208 water quality management program grant from EPA. Average groundwater quality information from that report is presented in Table 2-9. Significant variations from these averages have been recorded. (See Esvelt 1978 for more detailed groundwater quality data.)

In summarizing the Spokane County 208 data, Esvelt (1978) reported the following:

- Dissolved solids concentrations increase downstream from the Idaho/Washington state line to Spokane.
- Dissolved solids concentrations are greater on the aquifer periphery where flow rates are lower.
- Historical records indicate a gradual increase in solids concentrations over time. At the same time, population has increased in the area.
- Salt concentrations are higher in groundwater in the vicinity of solid waste disposal sites than in surrounding areas.
- Chromium and mercury have been found in concentrations approaching drinking water standards.

Table 2-9. Spokane Valley Aquifer Cross Section Water Quality Averages Compiled in the Spokane County 208 Study

Cross Section	Conductivity µ mho/cm	TDS[1] mg/ℓ	NO_3-N mg/ℓ	Cl mg/ℓ
State Line[2]	259	155	0.92	0.79
Greenacres[3]	268	161	1.18	1.11
Dishman[4]	302	184	1.68	3.16
Parkwater[5]	287	173	1.81	2.98
Parkwater-North[6]	260	156	1.17	1.63
North Spokane[7]	282	169	1.59	2.59
Outlet[8]	361	217	2.23	7.20

[1] TDS (total dissolved solids) = 0.60 x conductivity.

[2] State Line concentration = 0.3 x Idaho Trent + 0.3 x Idaho Beck + 0.3 Idaho CID + 0.1 x Highway Dept.

[3] Greenacres concentrations = 0.15 x CID 2/3 + 0.35 x Campbell-Mission + 0.3 x Campbell-Euclid + 0.2 x Gunderson.

[4] Dishman concentration = 0.05 x Edgecliff + 0.3 x Balfour Park + 0.3 x Valley Mission Park + 0.3 x 208 Irvin + 0.05 x Pleasant Prairie.

[5] Parkwater concentration = 0.1 x E. Spokane W.D. + 0.15 x WWP 1-5 + 0.15 x Milwaukee + 0.15 x CPM + 0.25 x SCC + 0.15 x WWP Substation + 0.05 x Old Dairy.

[6] Parkwater - North is an estimate of water quality at Parkwater which flows north under the City to the North Spokane Cross Section. Concentration = 0.1 x Milwaukee + 0.2 x CPM + 0.35 x SCC + 0.25 x WWP Substation + 0.1 x Old Dairy

[7] North Spokane concentration = 0.15 x Whitworth 1 + 0.15 x WWP 3-1 + 0.2 x Spokane Central + 0.15 x Ray/Bennett + 0.2 x Arlington + 0.15 x North Spokane W.D.

[8] Outlet concentration = 0.2 x Griffith Springs + 0.7 x Waikiki Springs + 0.1 x Wandermere Springs.

SOURCE: Esvelt 1978, Table 2

- Organochlorides and cyanide have been found in the aquifer.

Esvelt (1978) concluded that "A substantial portion of the aquifer dissolved solids increase has resulted from man's activities over and adjacent to the aquifer. Increase in these activities accompanying population growth (urbanization) over the aquifer and on lands tributary will result in increasing deterioration of aquifer water quality".

Present Health Threat

Approximately 295,500 persons now reside in the CWMP General Sewer Service Area (GSSA). (See Figure 2 for GSSA boundary.) The City of Spokane provides wastewater service to about 174,500 of these people. The remainder are served by either small interim facilities or individual on-site facilities. No recent estimate of the number of on-site systems has been made, but Economic and Engineering Services, Inc. (1980a) report that the Metropolitan Spokane Water Resources Study (completed in 1975) indicated 84,000 persons in the metropolitan area were served by on-site systems at that time. The majority, 62,000, resided in Spokane Valley west of Sullivan Road. An additional 6,000 resided farther east in the Valley. The north Spokane suburban area contained about 16,000 unsewered residents (Economic and Engineering Services, Inc. 1980a).

Data compiled by the Spokane County Health District (1978) as part of the County 208 program show that 4,365 additional on-site disposal applications were reviewed by the County between January 1976 and May 1977. The majority of these came from the central portion of Spokane Valley.

The majority of these on-site wastewater disposal systems are located over or in areas tributary to the Spokane Valley Aquifer. The highly permeable nature of the soils and subsurface alluvial deposits over the aquifer have prompted recent studies to investigate whether or not the domestic wastes are degrading the water quality of the aquifer. The 208 studies in both Kootenai County, Idaho (Panhandle Area Council 1978) and Spokane County, Washington (Esvelt 1978) conclude that on-site wastewater systems are contributing contaminants to the aquifer. The Spokane County 208 study also identified surface runoff and chemicals applied to the land surface by man as potential aquifer contamination sources.

While the water quality of the aquifer currently meets NIPDWR standards, the trend toward poorer quality is the primary concern.

Nitrate levels in groundwater are often used as a measure of drinking water quality and the relative influence of man's activity on groundwater. The NIPDWR standard for nitrate is 10 mg/l (NO_3-N). Well samples collected as part of the 208 groundwater monitoring effort found nitrate levels ranging from less than 1 mg/l in many wells to nearly 9 mg/l in several locations (Esvelt 1978). The majority of recordings, however, were relatively low. Of the 72 monitored wells listed in Esvelt's (1978) 208 monitoring summary (Table 1), 82 percent had average nitrate values less than 3 mg/l. Several samples showing greater than 6 mg/l nitrate were extracted from wells on the northern periphery of the aquifer. These may be influenced by waters flowing out of the Peone Prairie area.

While trends in nitrate levels are not well documented, the historic record does indicate a gradual increase in groundwater salt content. This has been taken as evidence that continued urbanization over the aquifer has gradually degraded aquifer quality and will continue to do so unless control measures are implemented (Esvelt 1978).

Other groundwater quality monitoring data support the contention that urbanization and increased human activity over the aquifer represent a public health threat through drinking water contamination. The Spokane County 208 reports (Esvelt 1978; Spokane County Office of County Engineer 1979) described instances of cyanide residuals in wells in the Hillyard-Mead area. EPA (pers. comm.) has also reported the presence of 1,1,1 Trichloroethane and chloroform in the aquifer. Trichloroethane is listed as a hazardous waste in the Resource Conservation and Recovery Act (RCRA). While the recorded levels do not represent an imminent health threat, they do indicate that increasing residential, commercial and industrial development over the aquifer are adversely affecting the quality of the area's drinking water.

The problem of aquifer contamination is continuing to be investigated. USGS has developed a model to be used in forecasting long-range changes in groundwater quality. This modeling is also being used in attempts to clarify the relative influences of on-site wastewater disposal systems and nonpoint sources of contaminants such as runoff from urbanized areas on the aquifer and adjacent upland areas. There have been some disagreements regarding the relative importance of on-site wastewater disposal and nonpoint sources of pollutants to aquifer quality.

Groundwater quality monitoring efforts are continuing in both Washington and Idaho. The findings in Idaho are of interest to Spokane County because any groundwater degradation that occurs in Idaho ultimately affects the Spokane water supply. Plans are now underway to provide central sewer service to residents of Post Falls and Coeur d'Alene, Idaho that now use on-site systems over the aquifer. As many as 5,000 on-site systems are expected to be eliminated in these communities over the next 20 years. This should beneficially influence aquifer quality.

The collected wastewater from Post Falls and Coeur d'Alene will be discharged to the Spokane River at least part of the year. While waste loads in the river could enter the aquifer in the zone of interchange below Post Falls, this treated surface discharge can be closely monitored and therefore poses less of a health threat downstream than continued use of on-site waste disposal or land application of wastewater over the aquifer. The continuing urbanization over the aquifer in Idaho, however, should be viewed with the same concern that is expressed for urbanization over the aquifer in Spokane Valley. This may ultimately have a more significant influence on aquifer water quality than the domestic waste disposal practices.

Regulatory Controls

A variety of federal, state and local regulations act to protect the Spokane Valley Aquifer as a domestic water supply. A brief description of the more important controls follows. The descriptions of state and local controls were taken directly from staff reports contained in the Spokane County 208 Project files (Washington DOE 1978).

- Federal Safe Drinking Water Act (PL93-523) - establishes maximum contaminant levels (MCLs) for a variety of water pollutants. These MCLs must not be exceeded in public drinking water supplies. Also allowed the EPA Administrator to declare the Spokane Valley-Rathdrum Prairie as a "sole source" water supply, thereby establishing special protection from federally regulated activities that might adversely affect the aquifer.

- Resources Conservation and Recovery Act (PL94-580) - requires manufacturers, transporters, storers or disposers of over 400 identified hazardous wastes to register with the federal government. Eventually will establish control guidelines to protect water supplies from these hazardous wastes. Proposed RCRA regulations would prohibit disposal of a hazardous waste in the recharge zone of a sole source aquifer unless it can be demonstrated that the disposal does not endanger the aquifer (40 CFR 250.43-1[g]).

- Washington Department of Social and Health Services (DSHS) drinking water regulations - DSHS adopted NIPDWR standards and now enforces drinking water protection regulations of the Safe Drinking Water Act. This includes protection of the "sole source" aquifer.

- RCW 90.48.110 requires that DOE review and approve sewage disposal systems and methods of operation and maintenance to assure that the facilities will adequately protect the quality of surface and ground waters.

- RCW 90.48.162 provides that any county or any municipal or public corporation operating a sewerage system which results in the disposal of waste material into the waters of the state shall obtain a permit from DOE.

- Guidelines based on the provisions of WAC 248-96-075 provide that DOE review and approve any on-site sewage disposal system of 50 services or greater or flows exceeding 17,500 gpd.

- Guidelines based on the provisions of WAC 248-96-075 provide that DSHS shall review engineering reports on a joint basis with DOE and may review and comment on final construction plans and specifications for on-site systems of 50 services or greater or flows exceeding 17,500 gpd. DSHS shall review and approve systems with flows exceeding 3,500 gpd or 10 services, but less than 17,500 gpd or 50 services.

- The DSHS establishes requirements and minimum standards for local health departments for regulating construction of new on-site disposal systems.

- RCW 43.20.050 provides that the State Board of Health supervise all matters relating to the preservation of the life and health of the people of the state. This includes the adoption of rules and regulations and standards for the prevention, control and abatement of health hazards and nuisances related to the disposal of sewage. Also included is the specific authority to adopt standards governing the design, construction and operation of sewage disposal facilities.

- The DSHS has primary jurisdiction over matters relating to the protection of drinking water supplies and the adoption of drinking water standards.

- Guidelines based on the provisions of WAC 248-96-075 provide that local health departments shall review and approve septic tank systems with flows less than or equal to 3,500 gpd or 10 services. Proposals for other types of disposal units shall be reviewed on a joint basis with DSHS.

- The State Platting Law (chapter 58.17 RCW) includes a section requiring local health department review of preliminary plats concerning the provisions being made for public water supply and sewage disposal.

- The Spokane County Utilities Department has review and approval authority over small community and individual on-site wastewater disposal systems (flows less than 3,500 gpm) in areas with approved general sewerage plans (GSPs). North Spokane has an approved plan, but other urban areas around Spokane do not. The Spokane County Health District has regulatory authority in areas without approved GSPs. The health district is also responsible for monitoring the operation of these small systems.

- The Spokane County Health District has been conducting an aquifer monitoring program as recommended in the Spokane aquifer 208 report. Approximately 100 wells are monitored. It is not known whether the program will continue through 1981 because of departmental budget cuts.

Impact of Wastewater Facilities Alternatives

No Action. If the County takes no action to provide centralized wastewater service around the City of Spokane, most residents in the area now using on-site disposal facilities will continue using them. Residents using small interim disposal facilities will also continue to rely on them. New construction in the County would probably also utilize on-site or small community systems for wastewater treatment and disposal. These systems would continue to contribute contaminants to the Spokane Valley Aquifer.

The actual size of this waste contribution has not been calculated, but evidence gained from groundwater quality monitoring (Esvelt 1978; Panhandle Health District 1977) does indicate that on-site disposal systems are contributing to groundwater degradation in both Spokane County and northern Idaho. It was reported in Economic and Engineering Services, Inc. (1980a) that there were 84,000 persons in the Spokane area using on-site systems in 1975. This did not include the persons using small central and interim treatment systems such as Ledgerwood, Millwood, Northwest Terrace and others. This unsewered waste disposal, most of which occurs over the aquifer, has undoubtedly increased significantly since then, as growth in the unsewered Spokane Valley and North Spokane areas has been steady since that time. These numbers would be expected to continue to rise under the "no action" alternative.

Walker et al. (1973) estimated that the average family of four contributed 73 pounds of nitrate (NO_3-N) to the groundwater each year through septic tanks in sandy Wisconsin soils. This number may not be directly applicable to the Spokane area because groundwater depths are different in the two areas and the similarity of soil conditions is not known other than that coarse glacial soils are found at each location. The Walker study does indicate, nonetheless, that nitrate contamination of aquifers in areas of coarse soils can be sizable. The cause for concern is heightened when urban densitites in Spokane Valley and North Spokane are considered.

The Spokane County 208 study did not attempt to estimate the amount of waste contaminants that might be contributed to the aquifer by a typical on-site disposal system. It did, however, develop average loading rates for residential areas using primary treatment systems (septic tank systems). The domestic waste load of an acre of residential land was estimated to be 45.7 pounds total nitrogen and 18.3 pounds of nitrate-nitrogen per year. This assumed a housing density of 3 dwelling units per acre, 3.3 persons per household and 60 gallons per capita per day water use. The effluent concentration assumptions were 23.9-32 mg/l total nitrogen (primarily ammonium) and .14-.3 mg/l nitrate-nitrogen (Spokane County, Office of County Engineer 1979a, Tables 11 and 12). Loading rates were also developed for other potential contaminants and other land use types (Table 2-10).

The fate of these wastewater contaminants, once they have been carried from septic tank to leach field, is speculative. Studies conducted in other parts of the country indicate most pathogens are effectively filtered out by the first few feet of soil material unless unimpeded channels exist in the subsurface. The fate of nitrogen compounds depends upon a variety of factors. If anaerobic conditions exist in the leach field, the ammonium in the effluent (about 80 percent of typical septic tank effluent nitrogen (U. S. EPA 1977) is converted to nitrogen gas. If aerobic conditions exist, however, much of the ammonium is converted to nitrate as it moves down through the aerobic soil layers. As mentioned earlier, nitrate is considered a health hazard if it exceeds 10 mg/l (NO_3-N) in drinking water. In the coarse soils of the Spokane area, aerobic conditions are likely to exist in most leach fields, so conversion of ammonium to nitrate

Table 2-10. Domestic Waste Load Assuming Primary Treatment[1]

lbs/acre/year

	BOD_5	TDS	Total Hardness	Alkalinity	Total-N	NO_3-N	Total P	Ortho-P	Cl-	SO_4=	Na^+	Hg	Pb	Cd	Cr	Zn	Ni	Cu	Pesticides	Total Coliform	Fecal Coliform	Complex Organics
Residential	256.0	584	146.0	146.0	45.7	18.3	14.6	14.6	137.0	51.1	119.0	0.0005	0.096	0.018	0.066	0.511	0.115	0.103	0.16	5×10^{13}	5×10^{12}	0.34
Commercial	175.0	195	48.6	48.6	15.2	6.2	4.8	4.8	45.6	17.0	39.6	0.0001	0.032	0.006	0.022	0.170	0.039	0.035	0.05	1.7×10^{13}	1.7×10^{12}	0.11
Industrial	55.2	126	31.6	31.6	9.8	4.0	3.2	3.2	29.6	11.0	25.8	0.0001	0.02	0.004	0.014	0.011	0.025	0.022	0.09	1.1×10^{13}	1.1×10^{12}	0.07
Average	212.0	410	101.0	101.0	31.7	12.8	10.0	10.1	95.2	35.5	82.7	0.0003	0.067	0.013	0.046	0.345	0.081	0.072	0.11	3.5×10^{13}	3.5×10^{12}	0.24

1. Septic tanks were considered to provide the equivalent of primary treatment.

SOURCE: Spokane County Office of County Engineers 1979a.

is expected. The amount of nitrate reaching the groundwater from a Spokane area on-site system has not been investigated to date.

There are currently no regulations that would restrict continued residential development and use of septic tanks over the aquifer if the County did not supply central wastewater service. If the County areas grow at the rate predicted in the CMWP, another 61,500 people might be using on-site or small community systems between now and 2002 in Spokane Valley and North Spokane alone. Most of these people would be located over the aquifer.

Economic and Engineering Services, Inc. (1980a) indicate there are 21 industrial facilities in the planning area that provide their own wastewater treatment and disposal. Most of these are located in the urbanized County areas of North Spokane or Spokane Valley. Most are located over the aquifer. Under the no-action alternative, these industries would continue to provide individual waste treatment.

A survey of waste loads and waste constituents from these industries has not been conducted, but the discharged materials range from sanitary wastes to cooling water, gravel wash water, uranium ore fines, aluminum milling process water, water softener regeneration water, asphalt batching process water and storm runoff. Future industrial development would also supply its own treatment or hook directly to City of Spokane or Liberty Lake Sanitary District waste facilities. These over-the-aquifer waste disposal practices pose a long-term health threat to persons drawing drinking water from the aquifer. The significance of the threat has not been determined; but, as stated earlier, the coarse nature of the soils in the area and the relatively small depth to groundwater encourages transport of materials in solution from the surface to the aquifer.

If the number of persons living and working over the aquifer increases as envisioned by the County Comprehensive Land Use Plan, and those persons continue to rely on on-site waste disposal, the quality of the groundwater should continue to gradually decline. The concentrations of salts, including nitrate, should gradually increase, eventually posing a health threat to those drinking the water.

Elimination of On-Site Systems. Each of the seven action alternatives (A through F) would provide the wastewater treatment system to start hooking up General Sewer Service Area residents and industries that now rely on their own wastewater systems. Each of the alternatives would also establish a framework whereby new residents in the unincorporated urban area could eventually hook up to a central treatment system. The exact number of interim and on-site facilities eliminated was not calculated in the facilities plan, but 90,000 persons (Table 2-25) are expected to be served by 1992 (Economic and Engineering Services, Inc. 1980a). Of this total, 61,000 are expected to be existing residents. By 2002, 176,050 persons would be using the County facilities. About 87,000 of these are expected to be current residents.

Many of the wastewater facilities eliminated early in the County sewering effort would be of the interim variety. Those areas with existing collector systems and small interim treatment facilities could more easily hook into the planned County interceptors. It is not known how many septic tank and drainfield systems would be removed in the early stages of the project. The timing and location of sewering efforts will be influenced more by the economics and politics of local improvement district formation than by the location of heavy septic tank use. The Phase 1 (1982-1992) sewering efforts are planned for the Priority Sewer Service Area (PSSA) (Figure 1-1), but areas outside that boundary could also be served if the connecting system could be financed. The initial sewering effort, however, should focus on the areas of greatest septic tank use.

The change this sewering effort would create in aquifer water quality would be positive. The actual change in contaminant concentrations, however, is unknown. There is insufficient information available to calculate the present levels of contaminants being added to the aquifer by over-the-aquifer wastewater disposal. In addition, the location and types of interim and on-site facilities eliminated have not been specified in the facilities plan. An estimate of the waste load removed from over the aquifer can be made, however, using the domestic loading rates contained in the 208 Plan (Table 2-10). Sewering of 87,000 existing septic tank or interim facility users would reduce the waste-related total nitrogen load by about 398,000 pounds annually. This load is presently available for transmission into the groundwater.

The seven action alternatives would also provide interceptor capacity for industrial flows (Table 2-11). Sewering of industries on West Plains would not remove a load from over the aquifer, but sewering industries in the Valley and North Spokane could. The facilities plan, however, does not stipulate whether these flows would be from existing or future industrial sources.

Increased Sludge Disposal. The facilities planners have calculated the volumes of sludge produced by each project alternative (Table 2-12). The volumes vary with the type

Table 2-11. Industrial Wastewater Flows Expected in the CWMP Facilities (MGD)

Source	1992	2002
Spokane Valley	1.0	1.2
North Spokane	.34	.39
West Plains	--	1.95

SOURCE: Economic and Engineering Services, Inc. pers. comm.

Table 2-12. Sludge Generated by the Project Alternatives

ALTERNATIVE	1992 lbs/day	2002 lbs/day
A	90,000	186,000
B	90,000	186,000
C	84,000	178,000
D	84,000	178,000
E	68,000	144,000
F	67,000	137,000

SOURCE: Modified from Economic and Engineering Services, Inc. pers. comm.

of treatment being proposed; alternatives providing phosphorus removal for all wastewater flows generate the most sludge. The land disposal schemes generate the least sludge.

Sludge disposal is an important groundwater quality consideration only if the disposal site is located over a drinking water supply. Many wastewater contaminants of concern (metals, nitrogen, certain types of salts) are concentrated in sludge by treatment processes. This material can be leached from the sludge and move downward through the soil column under certain hydrologic and soil conditions. The chemical nature of sludge generated at the City STP is summarized in Table 2-13.

The City of Spokane currently disposes of its wastewater sludge at a sanitary landfill on the northwest edge of town between Nine Mile and Indian Trail Roads. This site is over the Spokane Valley Aquifer but downgradient from most major water wells. Esvelt (1978) reported that well monitoring in that area shows increased conductivity, chloride and nitrate concentrations in the vicinity of the landfill. Two small wastewater lagoons are also in the area. It was concluded that the waste disposal practices in this area were degrading the aquifer. Esvelt cites further evidence that industrial-related aluminum and cyanide waste disposal over the aquifer has resulted in a long-term degradation of groundwater quality. Each of the CWMP alternatives would increase the sludge volumes generated at the City treatment plant, and therefore, the amount of sludge being disposed of over the aquifer.

Alternative A would generate the largest increase in sludge at the City plant. All County flows would eventually be diverted to the City facility. Alternatives C and F would be the next largest contributors, followed by B, then D and E (Table 2-14). These sludges would be disposed of along with City-generated sludges. The City is studying the possibility of changing its sludge treatment and disposal practices; landfilling may eventually be eliminated in favor of spreading a liquid sludge on agricultural lands west of the Spokane River and north of Airway Heights. This would move the sludge off the aquifer and eliminate the chances of further groundwater quality degradation. This new disposal technique is tentative, however, and would probably be implemented gradually, after a small-scale test operation. Therefore, County-generated sludge will probably be disposed of over the aquifer for some period of time, posing an increasing threat to persons drawing drinking water from the aquifer in the vicinity of the landfill.

Table 2-13. Chemical Nature of Spokane STP Sludge[1]

	LIQUID PORTION (mg/l)		SOLID PORTION (µg/gm)	
Parameter	Digester Filter Room	Filtered	Digester Filter Room	Filter Cake Sludge
Aluminum	4.7-14	1.6-10	34,000-42,000	19,600-24,000
Copper	.08-.18	.13-.18	310-390	200-250
Cadmium	<.02	.04-.06	10-13	9.3-12
Zinc	.15-.5	.04-.06	1,000-1,100	640-730
Nickel	<.02-.03	.03-.05	21-30	26-38
Lead	<.2	<.2	360-390	230-280
Mercury	.001-.0014	.001-.0019	3.5-4.5	2.2-3.0
Arsenic	.008-.019	.001-.016	38-62	20-46
Potassium	---	---	500-2,200	820-1,300
Calcium	150-600	1,800-3,800	35,000-45,000	140,000-182,000

1. Samples collected the weeks of September 4, 13 and 20, 1979.

SOURCE: Washington Department of Ecology 1980a.

Table 2-14. Increased Sludge Loadings at the Spokane City STP

	Sludge Increase (lbs/day)	
ALTERNATIVE	1992	2002
A	90,000	186,000
B	29,700	58,700
C	65,880	154,510
D	4,960	25,660
E	4,960	25,660
F	48,700	114,150

SOURCE: Calculated from data in Table 2-12.

The concern over sludge percolate is due not only to the nitrates that might reach the aquifer, but also to heavy metals (Table 2-13) and other contaminants that might be present. There are no major wells in the area except the Livengood well to the south, but many people residing to the north have individual wells. Section 1424(e) of the Safe Drinking Water Act (SDWA) prohibits federal grant assistance of projects which the EPA Administrator determines might create a significant health hazard within a sole source aquifer. In addition, proposed rules for implementation of the federal Resource Conservation and Recovery Act (RCRA) prohibit disposal of a hazardous waste in the recharge zone of a sole source aquifer unless it can be demonstrated that the disposal does not endanger the aquifer (40 CFR 250.43-1[g]). Municipal wastewater sludge can be designated a hazardous waste under RCRA if it is found to contain high levels of any of the over 400 hazardous materials presently listed in RCRA. The proposed rules also prohibit the location of solid waste disposal sites over a sole source aquifer unless alternatives are not feasible and the aquifer's water quality is not endangered.

Sludge generated at the North Spokane or Felts Field treatment plants would be processed, then disposed of in County landfills. The Colbert and Mica sites would probably be used. These landfills are not over the aquifer; their use, therefore, should not result in degradation of the quality of the underground water supply.

Surface Water Contamination and Recharge of the Aquifer. Drost and Seitz (1978) found that the Spokane River loses water to the Spokane Valley-Rathdrum Prairie Aquifer between Post Falls, Idaho and Greenacres, Washington. The average interchange was estimated to be relatively small at 80 cubic feet per second (cfs); the river flow at Greenacres averages 6,200 cfs. Esvelt (1978) indicates the river also recharges the aquifer at times near Upriver Dam and at other river reaches where the net average annual flow is from the aquifer to the river.

Because these interchanges are upstream from most of Spokane's water supply wells, the Spokane County 208 Plan recommended that no additional sanitary wastewater be discharged to the Spokane River above Upriver Dam unless it be of potable water quality (Spokane County Office of County Engineer 1979).

Each of the CWMP alternatives recognizes that there will be a small wastewater discharge from the Liberty Lake STP in this aquifer interchange area. The plant construction and waste discharge have already been authorized by EPA and

DOE. This is planned as an interim facility, however, and waste flows from this area will eventually be tied by interceptor to the rest of Spokane Valley. The plant now under construction has a 1 mgd capacity. Wastewater flows from the area are expected to increase to 3 mgd by 1992 when the CWMP predicts the Liberty Lake interceptor connection would occur. Therefore, the Liberty Lake plant must expand to accommodate the predicted flows, or the connection must occur sooner than predicted in the CWMP phasing.

The Liberty Lake plant discharge will be of secondary effluent quality. Whether the discharge is 1 mgd or 3 mgd, it could have some influence on the quality of well water extracted downstream. The City's Well Electric and Parkwater Wells are both relatively close to the river, about 12 river miles downstream. A significant degradation should not occur, however, unless untreated bypasses occur. Construction of an emergency storage pond would reduce this possibility.

Alternatives B and D would also place a new sanitary waste discharge in a recharge area. These alternatives include a new plant at Felts Field. The waste discharge would eventually reach 19 mgd (average dry weather flow) and would enter the river just upstream from Upriver Dam (see Figure 2-1). This flow is expected to include 1.2 mgd of industrial source wastewater by 2002. Although there is no evidence that the Well Electric and Parkwater Wells are directly influenced by the river (Saty pers. comm.), other supplies drawn from the aquifer downgradient could be degraded. The size of the wastewater flow is sufficient to warrant concern. The wastewater would receive secondary treatment, phosphorus removal and disinfection prior to discharge.

Land Disposal of Wastewater. Alternatives C, D, E and F each involve land disposal of wastewater. Both C and D would dispose of North Spokane's waste flows in the Rutter Parkway area (Figure 2-3) while E would combine flows from North Spokane, Spokane Valley, Moran Prairie, Liberty Lake and Newman Lake for disposal in the same area. Alternative F would take the entire wastewater flow of the metropolitan Spokane area and discharge it to land north of Long Lake in Stevens County (Figure 2-3).

The North Spokane Wastewater Facilities Plan (Kennedy Engineers 1979) studied the Rutter Parkway and Stevens County disposal sites in detail. The CWMP has taken the North Spokane plan information and modified it to account for the larger waste flows of Alternatives E and F. The Kennedy Engineers report has been referred to for much of the data in this analysis.

Alternatives C and D. These alternatives have identical land disposal proposals. The entire wastewater flow from North Spokane would receive secondary treatment at the Rutter Parkway site prior to disposal through percolation/infiltration beds. The average dry weather waste flows are estimated to be 3.6 MGD by 1992 and 4.7 MGD by 2002. The wastewater would be disinfected prior to discharge to the 63-acre land area.

The CWMP did not analyze the potential for migration of wastewater contaminants from this disposal area to the underlying groundwater. The facilities plan engineers did, however, estimate the pre- and postpercolate quality of the effluent (Table 2-15). It is likely that the wastewater would eventually alter the quality of groundwater below the site, but the degree of change is unknown. The soils in the area are Marble sandy loam, Springdale gravelly sandy loam, deep, and Springville cobbly sandy loam (U. S. Soil Conservation Service 1968). They are coarse and highly permeable with very little clay; this facilitates rapid movement of the water into the subsurface strata.

The Rutter Parkway disposal site is over the Spokane Valley Aquifer, but is at its extreme northern edge, downstream from the principal water extraction areas. The depth to groundwater is much deeper here than in other areas, being as much as 200 feet. There are no major water wells in the area; Kennedy Engineers (1979) reported that 27 homes are supplied water from the aquifer near the Little Spokane River. It is felt that the aquifer has no potential for significant water development in the Rutter Parkway area; water would have to be imported to supply urban or suburban residential densities (Kennedy Engineers 1979). Therefore, the Alternatives C and D land disposal operations would be unlikely to create a significant health hazard in the groundwater, except for the residents of the 27 homes identified by Kennedy Engineers. These wells would have to be monitored to detect changes in quality caused by the wastewater. A new water supply source might have to be developed for the area.

Alternative E. The impacts of Alternative E would be similar to those of C and D, except on a larger scale. Waste disposal would occur in the same general area, but the flow would be 19 MGD greater by 2002. A larger land application area would also be used (300 acres eventually).

Alternative E includes waste flows from Spokane Valley as well as North Spokane. Industrial contributions to the waste stream would therefore be greater. This deserves mention because industrial flows are often a source of chemical cleaners and process residues that are hazardous to humans in low concentrations. Groundwater monitoring requirements would probably be more extensive for Alternative E than for C or D.

Table 2-15. Quality of Land-Applied Wastewater

	Prepercolate[1]	Postpercolate[2]
BOD (mg/l)	25	0.3
Suspended Solids (mg/l)	20	0.2
Ammonia (mg/l)	14.6	---
Total Nitrogen (mg/l)	19.2	13
Total Phosphorus (mg/l)	8	1.0
Fecal Coliform (MPN/100 ml)	200-500	2.5
TDS (mg/l)	500	---

1. SOURCE: Collins, Ryder and Watkins pers. comm.

2. SOURCE: Collins, Ryder and Watkins pers. comm.(a)

Alternative F. Land disposal of wastewater at the Downriver Stevens County site (Figure 2-3) would not have an impact on the Spokane Valley Aquifer. The site is downstream from the aquifer sensitive zone on a bench nearly 300 feet above Long Lake. It has not been developed extensively for residential or agricultural uses, but may be in the future, due to its proximity to Long Lake. A search of DOE records located only one well in the immediate area, and it is downslope to the west, near the lakeshore.

The soils on the site are Dart silt loam. Bovay Engineers (1975) considered it as a sludge disposal site for the City of Spokane, but felt that residential development pressures and the porous nature of the soils made it undesirable. It is likely that land disposal of such a large volume of wastewater on this upland area would eventually degrade the groundwater that does exist below the site, and would also eventually affect the quality of Long Lake. The lake is immediately downslope of the disposal area.

Risk Analysis

Three basic approaches to wastewater treatment and disposal have been analyzed on the preceding pages, with a focus on their groundwater quality impacts. These three approaches are: 1) continued reliance on interim and on-site facilities; 2) collection, advanced treatment, and river disposal; and 3) collection, secondary treatment, and land application. As noted throughout the preceding pages, it is difficult to quantify the groundwater impacts of any of these options. Therefore, it is valuable to summarize the various subjective elements of risk that can be associated with each disposal mode.

Comparative Benefits. The most obvious short-term benefit of continuing to rely on individual waste disposal systems (no action) is a cost savings to existing County and City residents. Money would not have to be generated for construction and operation of one of the central treatment facilities. The river discharge options require a lower initial capital investment than the land disposal options. Alternative A has a Phase 1 capital cost $9,645,000 lower than Alternative C and $45,655,000 lower than Alternative E. This short-term cost savings should be tempered, however, by the possibility that on-site disposal over the aquifer might eventually degrade groundwater quality to the point where it would have to be highly treated before consumption, or a new source of water might have to be sought. This would have long-term cost implications.

Alternative A provides an added benefit when compared to Alternatives B and D in that all waste flows are transported downstream of the City prior to discharge. This eliminates the chance that treated wastewater could affect groundwater supplies through aquifer-river interchange. Public health, aesthetic and psychological benefits would accrue to uses of the Spokane River as it flows through Spokane Valley and the City of Spokane. In contrast, the upriver disposal options (B and D) provide a degree of surface water quality and beneficial use protection to Long Lake that is not inherent in Alternatives A and C. By discharging effluent farther upstream, the natural biological and physical action of the stream environment can have a greater chance to remove waste-related nutrients or other contaminants through settling or uptake by stream organisms. The closer the discharge is to Long Lake, the less chance there is to reduce the wastewater impact. The land disposal options (C, D, E and F) have one added benefit. By removing a portion or all of the waste flow from the Spokane River, the potential for adverse impacts on the river's beneficial uses would be reduced. Public health, aesthetic and psychological benefits would be realized by most river users, especially those enjoying water contact recreation in the summer low flow periods.

Knowledge of Contamination Mechanism. Technical knowledge of the real health risks created by contamination of water supplies with elements and compounds labeled as hazardous is relatively incomplete. Many water contaminants have been labeled as hazardous after relatively brief laboratory testing on animals. However, public health testing must be stringent and is designed to provide maximum protection to the public. Testing results have provided sufficient proof that a hazard to man exists if certain materials are ingested by drinking water. In addition, knowledge is very limited regarding the quantity and numbers of hazardous wastes likely to be in Spokane County's effluent. In light of this imperfect technical knowledge, a judgment must be made whether it is better to dispose of the effluent on the land or in the river. To help define this issue, the relative knowledge of pollutant transfer from disposal area to drinking water supply can be compared.

The transfer or convergence of wastewater constituents from a sewage outfall to the river is easily understood, and the levels of contamination can be easily estimated and measured downstream.

In comparison, the transfer of pollutants from septic tank systems and land application sites to the groundwater is not as well understood and definitely less observable or measurable. Some information is available about the filtering ability of soils, but this pertains primarily to classic pollutants, such as nitrate, bacteria. viruses and heavy metals. Relatively little is known about the fate of the many complex organic compounds now being produced by man and considered hazardous. In addition, the actual hydraulic relationship between land-applied wastewater and the underlying aquifer is only speculative. The ability to monitor and detect the transfer of pollutants from a multitude of on-site disposal systems or a central land disposal site is poor compared to river discharge.

Probability and Cost of a Catastrophic Impact. Probably the most severe or catastrophic event that could be associated with disposal of wastewater in the CWMP study area would be an uncontrolled discharge of untreated and/or highly toxic materials. This could be created by an undetected release of toxic materials at an industrial disposal site or a discharge into a newly constructed County interceptor system. This worst-case scenario would not be a serious public health threat unless it contaminated a drinking water supply or water contact recreational waterway.

If such an event were to occur in a Spokane River discharge, the river itself would immediately be a health threat to those persons drawing drinking water from the river and those water contact recreationists using the river downstream. Some portion of the contaminant could also eventually move into the aquifer through the river's recharge zone and threaten major groundwater supplies downgradient (Alternatives B and D). The positive aspect of the river discharge option is that the chance of early detection of the hazardous discharge is much greater than with on-site or centralized land disposal. Cleanup of the river would also proceed more rapidly due to the natural cleansing action of sunlight and the biological activity normally found in a stream. Until the contamination was cleaned up, the comparatively small number of contact recreationists would have to avoid the river.

If a hazardous discharge occurred at a land disposal site, there would probably be no immediate public health threat. Depending on the nature of the contaminant and its propensity for uptake by plants or adsorption to soil particles, there is the possibility that it may not migrate to the groundwater supply. The negative side of land discharge is that once any hazardous material moved below the aerobic soil layer, it would be exposed to little or no biological modification and could not be cleaned up by human action. If an acute or chronic discharge of toxic materials did enter the groundwater and create a public health hazard upstream from Spokane, an extremely large segment of the area's population might have to seek a new water source. The major land disposal options, however, are located downstream from Spokane's water supply. Therefore, no major health threat would be created.

The undetected toxic discharge would pose the greatest hazard under no action. All wastes in Spokane Valley would continue to be treated individually and disposed of over the aquifer upstream from the area's major water wells.

Latency. The actual health effects of groundwater contamination, if it were to occur, might not be felt for many years, and might never be positively traceable. This is due, in part, to the fact that some waste materials are hazardous only after chronic exposure over relatively long time periods. It might also take a considerable amount of time for hazardous materials to migrate from the disposal area to a portion of the groundwater that is being used domestically. The travel time would be much slower from the land application operations, but the eventual effect could be similar for land disposal and river discharge. Tracing a hazardous discharge and assigning liability for it would be easier with a river discharge of wastewater than with land application.

Irreversibility. Water contamination created by a surface water waste discharge would be much easier to correct than one created by land disposal operation. A surface water contamination can be detected more readily. It is also usually subject to greater diffusion and dilution, and it is more accessible to natural or human cleanup.

Mitigation of Potential Groundwater Quality Impacts

Legal Authority for Mitigation. There are a number of federal laws and regulations which allow EPA to reduce the probability that a groundwater-related health hazard would be created by disposal of Spokane County wastewater. The Clean Water Act gave EPA permit authority over any wastewater discharge to surface waters of the United States. This permit authority has been delegated to DOE in the State of Washington. The DOE-issued NPDES permit will specify the level of wastewater contaminants (5 conventional plus any of over 65 priority pollutants) that can be contained in any CWMP effluent discharged to surface waters (33 USC 1251 Sec. 402[a]). In addition, the Clean Water Act allows EPA or its delegated agent to require an inventory of significant industrial or commercial waste stream sources and a pretreatment ordinance for waste streams containing a toxic pollutant (33 USC 1251 Sec. 402 [b][8]).

The federal Safe Drinking Water Act, which gave EPA the authority to designate the Spokane Valley Aquifer as a sole source water supply, also prohibits EPA from funding a project which would create a significant health hazard in the aquifer (42 USC 300f, 300h Sec. 1424[e]). To meet this legal requirement, EPA can place conditions (i.e., monitoring requirements, operational requirements, etc.) on any grant to Spokane County for design and construction of wastewater facilities.

Finally, EPA can indirectly identify potential water quality problems through the Resource Conservation and Recovery Act (RCRA) (1976). This act allows EPA to inventory and establish storage, treatment and disposal regulations for over 85 waste streams and 400 chemical discards. These regulations are aimed primarily at control of industrial and commercial operations dealing with hazardous wastes. Domestic wastewater is excluded from RCRA control, but sludges are not. All industries in the Spokane area that generate, store, treat or dispose of any of these hazardous wastes must register with EPA. This registration process, along with an inventory of industrial and commercial wastewater hookups, would allow EPA to identify potentially hazardous materials in wastewater effluent.

Mitigation Strategy. There are no formal federal regulations or EPA policies for control of wastewater disposal over a sole source aquifer. Regulations are being developed on a national level but are incomplete. There is a set of general regulations for land disposal of wastewater over a subsurface water supply (Alternative Waste Management Techniques for Best Practicable Waste Treatment Technology, Federal Register, February 11, 1976), which establishes minimum protection of a sole source water supply. These regulations should be used in the design of any CWMP wastewater facilities. More specific mitigations for potential groundwater quality impacts are listed below. Many have been taken directly from the County 208 Plan (Spokane County Office of County Engineers 1979; Esvelt 1978).

No-Action Mitigations.

- Maintain low residential densities over the surface of the aquifer by modifying the County Comprehensive Plan.
- Require use of best available on-site waste disposal technology for all new developments.
- Limit new industrial and commercial developments over the aquifer.
- Continue to monitor groundwater quality throughout the aquifer area.

Sludge Disposal Mitigations.

- Minimize the amount of wastewater being treated for phosphorus removal by selecting a land disposal option or removing phosphorus only seasonally.
- Discontinue sludge disposal at the City's northwest landfill in favor of disposal or reuse off of the aquifer.
- Enforce pretreatment requirements on any industrial or commercial discharger to the CWMP collection system.
- Continue to monitor groundwater in the vicinity of the City's northwest landfill.

Mitigation for Surface Water Discharges Upstream of Spokane.

- Conduct a thorough hydrogeologic investigation of water movements between the river and the aquifer from Harvard Road to Upriver Dam.
- Enforce pretreatment requirements on any industrial or commercial discharger to the CWMP collection system.
- Require advanced waste treatment at plants discharging upstream of Spokane.
- Use an outfall diffuser to maximize initial wastewater dilution.
- Closely monitor wastewater effluent and groundwater downstream from discharge.
- Provide emergency storage at treatment plant sites.

Land Disposal Mitigations.

- Monitor effluent quality prior to land disposal.
- Establish and maintain an industrial connections inventory consistent with the Clean Water Act's pretreatment requirements.
- Establish EPA-approved monitoring wells upgradient and down-gradient of disposal sites.
- Sample monitoring wells for all Safe Drinking Water Act maximum contaminant levels (MCLs) and other pollutants from the priority pollutant list prior to land discharge. (See Appendix B for priority pollutants list.)

- Monitor wells quarterly for MCLs and other priority pollutants found in initial effluent monitoring.

- Enforce pretreatment requirements on any industrial or commercial discharger to the CWMP collection system.

- Monitor for all priority pollutants at each well once annually.

- Monitor Little Spokane River water quality below the Rutter Parkway disposal area to detect any change in surface water quality.

- Adopt a spray irrigation mode of land disposal rather than the proposed rapid infiltration.

- If the above-described monitoring program indicated that degradation was occurring, EPA would require added treatment, tighter controls over dischargers to the system, prohibition of certain surface activities, or provision of an alternative effluent disposal system. It should be noted that the list of MCLs may be expanded in the future, and the pending sole source regulations may place more stringent control on federally-funded land application systems.

General Mitigations.

- Minimize infiltration from wastewater interceptors over the aquifer by closely monitoring and controlling the quality of interceptor construction and periodically inspecting the interceptors for leaks.

Conflicts with Vegetation and Wildlife Resources

Existing Flora and Fauna

The flora and fauna of the project study area and the Spokane River corridor from Long Lake Dam to the state line are briefly discussed herein. A discussion of the biological resources of the Spokane area was previously presented in the Draft EIS for the City of Spokane, Combined Sewer Overflow Abatement Project prepared by EPA (1979), while a more thorough review and lists of plants and animals found in the study area can be found in reports by the Spokane County Planning Department (1980), the Spokane City Plan Commission (1976), and the U. S. Army Corps of Engineers (1976, Appendix E).

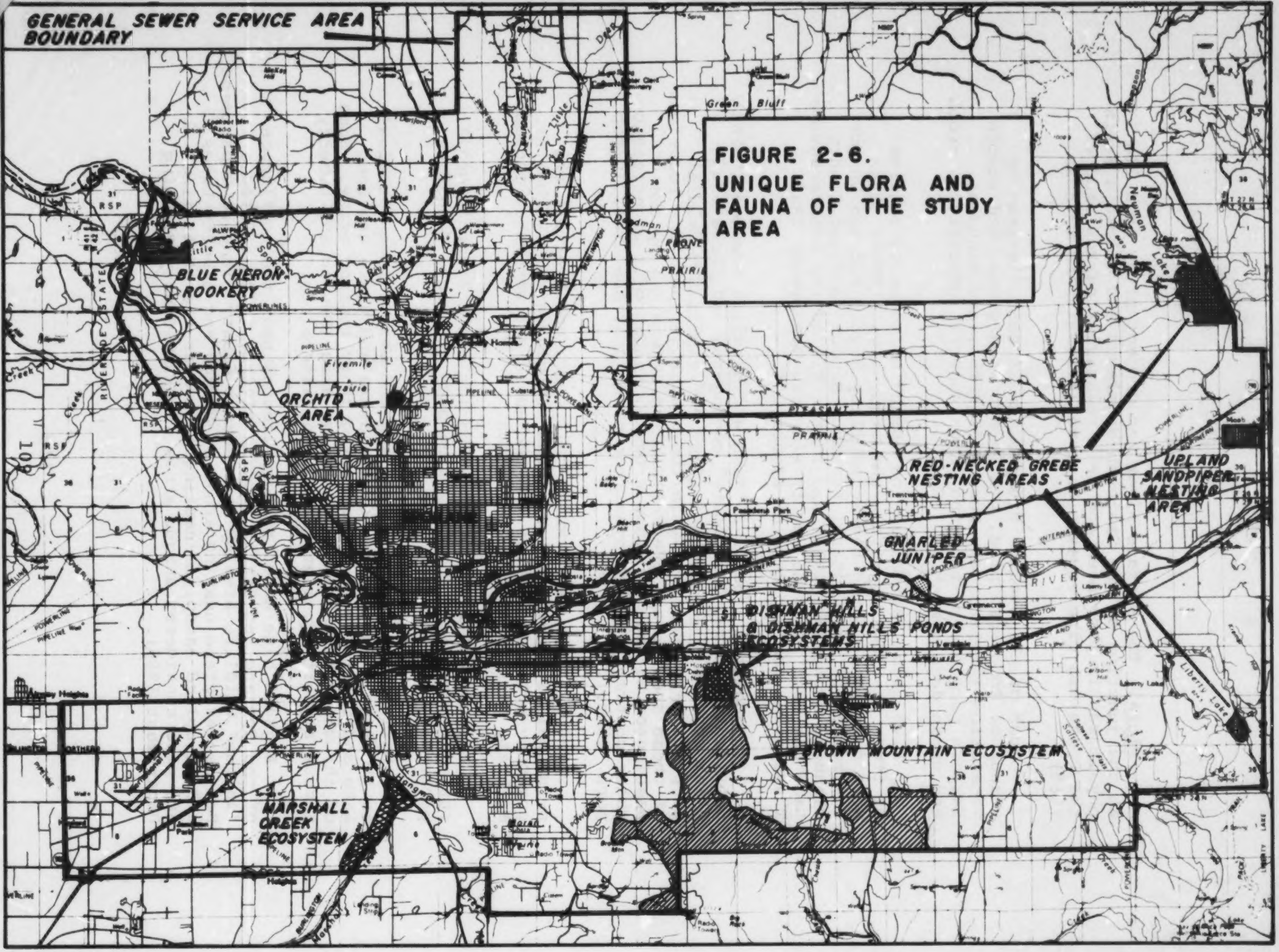


FIGURE 2-6.
UNIQUE FLORA AND FAUNA OF THE STUDY AREA

Flora. The Spokane River and project study area lie at the junction of the Okanogan Highlands and Columbia Basin physiographic provinces and in a relatively narrow band of the Ponderosa pine vegetation zone (Franklin and Dyrness 1969).

Much of the Spokane River Basin is characterized by stands of Ponderosa pine, blue bunch wheatgrass, and steppe vegetation (bitterbrush, perennial forbs, and annuals). Eastern portions of the study area support agricultural crops and urban development.

Five sites recognized for unique or numerous species of flora are located within the study area. These sites were described in the Land Capability Report and the Unique Environmental and Cultural Features Report (Spokane County Planning Department 1976) and in the EIS on the Comprehensive Land Use Plan (Spokane County Planning Department 1980). These sites are depicted on Figure 2-6.

In addition, the U. S. Fish and Wildlife Service (USFWS) has identified two "candidate" endangered and threatened plant species (*Balsamorhiza rosea* and *Silene spaldingii*) as possibly occurring within the planning area. The locations of these species are presently being determined by the Washington Natural Heritage Program, a nonprofit organization under contract to the Department of Natural Resources (Olsen pers. comm.).

Fauna. Mule deer, white-tail deer, and bear are the principal big game species of the planning area. Furbearers commonly occurring within the Spokane River watershed include muskrat, mink, beaver, and raccoon.

Upland game birds of the area include California quail, ruffed grouse (most common), ring-neck pheasant, Hungarian partridge, and mourning dove.

Mallards and Canada geese are the most common waterfowl in the area. Populations of the ducks and geese use Long Lake and other impoundments as migratory resting areas. Some of the water bodies in the planning area (Newman and Liberty Lakes) support a variety of nesting waterbirds.

A great blue heron rookery located near the confluence of the Spokane and Little Spokane Rivers, is considered a "unique" wildlife area by the Spokane County Planning Department. Red-necked grebe nesting areas at Newman and Liberty Lakes and an upland sandpiper nesting area near the state line are also considered unique areas (Spokane County Planning Department 1980).

The USFWS has identified three "candidate" endangered or threatened species of animals (Swainson's hawk, long-billed curlew, and snowy plovers). The presence of these three species is being determined by the nongame program staff of the Washington Department of Game. In addition, the bald eagle, an officially listed endangered species, is known to occur in the planning area. Washington Department of Game personnel are also determining the presence of nest sites or key wintering areas for the bald eagle within the planning area.

Impacts of the Alternatives on Terrestrial Flora and Fauna

No-Action Alternative. Under the no-action alternative existing vegetation and wildlife resource values would be maintained at all proposed storage basin, treatment plant, and wastewater disposal sites. These sites would be available for other uses depending on zoning and the Comprehensive Land Use Plan designation.

Alternative A - Regional Treatment at Spokane Plant. Project components of Alternative A would include the existing City of Spokane treatment plant, existing Lidgerwood lagoons near Holland and Dakota in North Spokane, two possible sites for storage basins in the Spokane Valley (both near Dishman), the Indian Trail storage basin, and a treatment plant at Liberty Lake. The Indian Trail basin would be a component of all alternatives.

Impacts on flora and fauna at existing facilities (Spokane treatment plant and Lidgerwood lagoons) would be nonexistent. The two possible storage basin sites near Dishman are existing gravel pits (sites having minor floral and faunal resources). The proposed Indian Trail storage basin and Liberty Lake treatment plant sites support annual and perennial grasses and some forbs. Both sites have minor value for wildlife. Facilities construction would eliminate approximately 4 acres of grassland habitat at the Indian Trail site and 40 acres at Liberty Lake.

Endangered, threatened, or candidate plant and wildlife species would not be affected by construction at any of these sites (Washington Department of Game pers. comm.; Washington Natural Heritage Program pers. comm.).

Alternative B - Separate Treatment for Spokane Valley. The components of Alternative B would be nearly the same as those defined in Alternative A, with the addition of a new sewage treatment plant at Felts Field in the Spokane Valley. No storage basins would be required in the Spokane

Valley. Approximately 29 acres of open field would be required for the treatment plant. Subsurface mammalian and some avian species would be affected by construction of the facility. The primary impact on wildlife would be the loss of seasonal feeding areas by bird species.

No endangered or threatened species would be affected by the project construction.

Alternative C - Separate Treatment for North Spokane. This alternative would require the construction of a new treatment plant and infiltration basins near Rutter Parkway in North Spokane. Approximately 63 acres of blue bunch wheatgrass, annual grasses, and other steppe vegetation would be eliminated, along with attendant wildlife species. The storage basin for the Spokane Valley (two alternative sites) would also be a component of this alternative. Impacts of that feature were described for Alternative A.

No known endangered or threatened species would be adversely affected.

Alternative D - Separate Treatment for Spokane Valley and North Spokane. Impacts on floral and faunal resources would be the same as described for Alternatives B (Felts Field treatment plant) and C (North Spokane treatment plant and infiltration ponds)

Alternative E - Land Application for Spokane Valley and North Spokane. Components of this project would include the Indian Trail storage basin and a large treatment and disposal site south of Rutter Parkway. The land area required for the plant and infiltration/percolation basins would be 300 acres (land now consisting of steppe vegetation described for Alternative C). The site is 2,000-4,000 feet south of the Little Spokane River and supports grasses and low herbaceous vegetation.

Alternative F - Land Application for All Planning Areas. The project components would include the Spokane Valley and Indian Trail storage basins, a new treatment plant (8 acres in size) near the confluence of the Little Spokane River and Nine Mile Road, and a 727-acre land disposal site north of Long Lake at Little Sandy Canyon.

The existing grassland-pine vegetation on the land application site would be removed for wastewater facilities, as would the grassland at the Indian Trail storage site. The Confluence treatment plant would remove agricultural land. The Confluence site is adjacent to a great blue heron rookery which is mapped by Spokane County as a unique environmental feature. The Washington Department of Game has given the great blue heron a "species of concern" status. Two other species of concern are also known to occur in this area. This includes the western bluebird and the black-backed three-toed woodpecker (Owens pers. comm.). While construction at the Confluence site would not remove the heron nesting area, the increase in human activity could discourage its use. The removal of the agricultural land would also reduce feeding area available to the western bluebird.

If the Confluence treatment site is to be used, it would be advisable to locate the facilities as far from the blue heron nesting area as possible. It would be preferable to investigate an alternative site for this facility so that use of the rookery would not be discouraged either by construction activity or long-term operation of a treatment facility. The Washington Department of Game nongame program office in Olympia should also be consulted before proceeding with design of a treatment facility in the vicinity of the Spokane and Little Spokane River confluence.

Conversion of Natural Land Resources

The EPA has policies concerned with the protection of natural land resources such as agricultural lands, wetlands, and floodplains. This section identifies which of these resources may be affected by the siting of the proposed facilities.

Prime Agricultural Lands

Prime agricultural land, as designated by the U. S. Soil Conservation Service, is located on one of the proposed facility sites. This is the 8-acre North Spokane Confluence treatment plant site. The Confluence site is presently under agricultural production, and would be lost only if Alternative F is selected as the preferred CWMP alernative.

Floodplains

No potential flood hazard areas have been identified on proposed wastewater facilities sites. Information was obtained from the National Flood Insurance Program to determine the 100-year flood hazard area.

Wetlands

No wetlands have been identified on the proposed wastewater facilities sites.

Mitigation

The prime agricultural land loss that would occur under Alternative F (Confluence treatment plant) could be mitigated by selecting a different treatment plant location. No other effective mitigation is available.

Potential Land Use Impacts

Introduction

One important issue in this EIS is the potential land use impacts associated with the proposed treatment facilities. To evaluate the potential impact, existing and future land use conditions must be examined. This section describes location and size characteristics of the proposed facilities, evaluates land use conditions associated with the proposed sites, and assesses potential land use impacts at the proposed sites.

Location and Size of Proposed Facilities

As presented in Table 2-16, most of the proposed treatment facilities are located in unincorporated Spokane County. Although the Indian Trail storage basin is at present located in the County, plans for annexation of this area by the City of Spokane already have been initiated. Felts Field treatment plant is located on the northeastern border of the City of Spokane. The Downriver disposal site, which is located in Stevens County, is the only proposed treatment facility located outside of the County of Spokane.

In general, the proposed treatment sites are located in rural, relatively uninhabited areas. The major exceptions are the Spokane Valley's storage sites and the Felts Field treatment plant.

Land requirements for the proposed facilities are presented in Table 2-16. The Downriver disposal site requires the largest acreage since all wastewater effluent would be pumped to the site for land disposal. The large-scale North Spokane treatment and disposal site also requires significant acreage (approximately 300 acres) in order to serve both Spokane Valley and North Spokane. Overall, Alternative F would require the most acreage (779 acres) and Alternative B would require the least acreage (55 acres).

Table 2-16. Location and Size Characteristics of Proposed Treatment Facilities and Disposal Sites

Proposed Facilities	Alternatives	Jurisdictional Location	Year 2002 Acreage Requirement
Storage/Equalization Basins			
Spokane Valley Storage Basins			43
primary site	A,C,F	County of Spokane	
alternate site	A,C,F	County of Spokane	
North Spokane Storage Basin	A,B	County of Spokane	22
Indian Trail Storage Basin	A,B,C,D,E,F	City of Spokane	4
Treatment Plants			
Liberty Lake Treatment Plant	A,B,C,D,E,F	County of Spokane	40
Felts Field Treatment Plant	B,D	City of Spokane	29
North Spokane Treatment and Disposal Site (small site)	C,D	County of Spokane	63
North Spokane Treatment and Disposal Site (large site)	E	County of Spokane	300
Confluence Treatment Plant	F	County of Spokane	8
Land Disposal			
Downriver	F	County of Stevens	727

SOURCE: Collins, Ryder and Watkins pers. comm.

Land Use Conditions Associated with the Proposed Facilities

Existing Land Use at the Proposed Sites. All of the proposed facility sites are located in areas which would require little if any clearing of obstructions. As shown in Table 2-17, most of the proposed sites are located in grassy fields or open space areas. One exception is the Spokane Valley storage basin sites. These sites are located in gravel pits which are, or have been recently, in operation. Another exception is the North Spokane storage basin site, which is currently occupied by wastewater treatment lagoons. Two of the other sites (the Liberty Lake treatment plant site and the Confluence treatment plant site) are situated (at least partially) on prime agricultural land. The Confluence site is being used for agricultural production.

Planned Land Use Designations for the Proposed Sites. Planned land use designations reflect the anticipated pattern of supply and demand in land use categories. The planned land uses of the proposed sites, as shown in Table 2-17, are designations from the City of Spokane Comprehensive Zoning Ordinance and the 1980 Spokane County proposed comprehensive land use plan. The proposed sites within the City are zoned R-1 which is intended primarily for the use of single-family residences. To locate treatment facilities in the R-1 zone, a zoning change and possibly a general plan amendment would be required.

The proposed sites in the County are located in areas designated primarily as rural in the Spokane County proposed comprehensive land use plan; therefore, treatment facilities would be considered inconsistent with the rural land use designation. In general, the siting of treatment facilities in a rural land use zone (or any other incompatible zone) would likely require a change in the Spokane County land use plan.

Adjacent Land Uses. To assess the potential land use conflicts associated with the proposed sites, the adjacent land uses of the sites must be considered. As previously mentioned, most of the sites are located in relatively uninhabited rural areas. The relationship between the operation of treatment facilities and the surrounding land uses (Table 2-17) is discussed in the following section.

Impacts

The land uses surrounding the proposed treatment and land disposal facilities are presented in Table 2-17. The operation of treatment and disposal facilities could result

Table 2-17. Land Use Characteristics of Proposed Treatment Facilities and Disposal Sites

Proposed Facilities	Existing Land Use	Planned Land Use[1]	Adjacent Land Uses
Storage/Equalization Basins			
Spokane Valley			
Primary Site	Gravel pit	Urban	Scattered residences on all sides; interspersed with open land to the east and south.
Alternate Site	Gravel pit	Industrial	Additional gravel operations, commercial and other industrial operations.
North Spokane	Wastewater treatment lagoons	Commercial	Vacant land on all sides with multifamily units in proximity to the south.
Indian Trail	Open grassy field	Residential (R-1)[2]	Open area on all sides with scattered residences (new developments) to the northwest and southeast.
Treatment Plants			
Liberty Lake	Open grassy area	Industrial	Vacant land surrounding the area with Highway 90 to the east and railroad tracks to the south.
Felts Field	Open field (sparse alfalfa crop)	Residential (R-1)[2]	Neighborhood park directly east with residential neighborhoods farther east and directly south. Open space to the north and west.
North Spokane (small)	Open grassy field	Rural	Open space consisting of fields and forested areas surrounding the site. Scattered residences to the north.
North Spokane (large)	Open grassy field	Rural	Open space consisting of fields and forested areas surrounding the site. Scattered residences to the north.
Confluence	Agricultural area	Rural	Open space on most sides with Nine Mile Road to the west and scattered residences to the south.
Disposal Area			
Downriver	Open grassy field and pines	NA	Open fields and sparsely forested areas. Spokane River to the west.

NA - not available

[1] As designated in 1980 Draft County Comprehensive Plan.

[2] As designated in 1977 City of Spokane Comprehensive Zoning Ordinance.

SOURCES: City of Spokane 1977.
Spokane County Planning Department 1980.

in adverse impacts on the adjacent human environment. The environmental impacts are: odor generation, noise generation, and visual detraction. This section discusses these environmental factors, evaluates the potential impact associated with each proposed site, and recommends potential mitigation measures.

Direct Environmental Factors.

Odor Generation. In general, the main source of conflict with wastewater treatment facilities is odor generation. At a treatment plant odors can emanate from different odor-producing points such as headworks, treatment basins or sludge-handling facilities. Proper design and operation are principal factors in determining if treatment facilities will emit odors. The degree of obnoxiousness of odors depends not only on the concentration of the odor and on the person exposed to the odor but also on the intensity of the odor (U. S. EPA 1976a).

The odor impacts associated with wastewater facilities can vary considerably according to the type of facilities under consideration. Since storage basins are essentially open reservoirs of untreated effluent they have the most potential for significant odor impacts. In general, treatment plants, even when properly operating, do have occasional odor problems. Odor problems associated with land disposal operations vary according to the type of disposal system. Odor problems often develop when over-application of treated effluent clogs soils and inhibits percolation.

The impact of odors is largely determined by prevailing winds. In the Spokane region winds from the west and southwest predominate, especially in summer when high temperatures present additional odor problems. Winds from the northeast often occur in winter months (U. S. Army Corps of Engineers 1976 Appendix E).

Noise Generation. Typically, adverse noise impacts are associated with the operation of treatment plants. Objectionable noise levels result primarily from trucking activity to and from treatment facilities, mainly treatment plants. Similiar to odor impacts, prevailing winds play a key role in the degree of impact. Other factors such as frequency of noise impact, level of noise impact, and individual perception are important considerations in the degree of impact.

Visual Appearance. Wastewater treatment plants often impose adverse visual impacts on surrounding areas. Although the degree of impact is dependent on individual perception the visual appearance of treatment plants often contrasts with the surrounding environment. This can result in an adverse aesthetic impact on a neighborhood or nearby road. Storage basins and land disposal facilities generally do not present adverse visual impacts.

Site Evaluation. The potential direct land use conflicts associated with the proposed facilities are presented in Table 2-18. The sites were evaluated in terms of odor, noise, and visual impacts. The potential degree of impact (i.e., high, moderate, or low) is based on the following factors: 1) the proximity of the sites to existing residential and highway uses, 2) location of the sites in relation to prevailing winds, and 3) frequency of exposure to impact (i.e., number of adjacent housing units or level of highway traffic).

As presented in Table 2-18, the potential direct land use conflicts associated with the proposed sites vary considerably. In general, the proposed storage basins have a relatively high potential for odor impacts, a low potential for noise impacts, and a relatively low potential for adverse visual impacts. The proposed treatment plants, with the exception of the Felts Field treatment plant, have a relatively low potential for odor impacts as a reslt of the relatively uninhabited areas in which they are located. The proposed Felts Field treatment plant presents the only moderate to high potential for noise impacts. All of the proposed treatment plants present a moderate to high potential for adverse visual impacts, primarily a result of visual detraction in otherwise natural areas (except Felts Field). The Downriver disposal area has a low potential for odor impacts and noise impacts. Visual impact is considered moderate at this site due to required clearing of the existing vegetation for infiltration/percolation basins near Nine Mile Road.

It should be noted that the preceding analysis examined potential land use conflicts from the viewpoint of existing land uses. If potential changes in land use are considered, additional conflicts become apparent. Undoubtedly, as development occurs in the outlying areas, the potential for land use conflicts at certain proposed sites increases. Therefore, although some proposed sites appear to be at present more desirable from a land use viewpoint, longer term land use requirements must be considered.

Mitigation Measures. The adverse environmental factors identified in Table 2-18 can be controlled. This would minimize objections to the treatment facilities. In some cases direct adverse effects can be significantly reduced by buffer zones. This could alleviate adverse visual impacts and help dissipate undesirable noise and odors. In other cases, however, additional measures are necessary. Table 2-19 identifies other potential mitigation measures

Table 2-18. Potential Direct Land Use Conflicts Associated with the Operation of the Proposed Treatment and Disposal Facilities

Treatment and Disposal Facilities	Direct Environmental Factors								
	Odor Impact			Noise Impact			Visual Impact		
	High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
Storage/Equalization Basins									
Spokane Valley									
primary site	x					x		x	
alternate site		x				x			x
North Spokane		x				x			x
Indian Trail	x					x			x
Treatment Plants									
Liberty Lake			x			x		x	
Felts Field	x			x		x		x	
North Spokane (small)			x			x	x		
North Spokane (large)		x				x	x		
Confluence			x			x		x	
Disposal Area									
Downriver			x			x		x	

Table 2-19. Potential Mitigation Measures for Land Use Conflicts

Odor Reduction

1. Ensure that all facilities are properly maintained, including all odor control equipment (digester covers, etc.).
2. Establish a means of monitoring plant odor production so that any off-site impacts can be rapidly detected and corrective action can be taken.
3. Locate treatment plant away from residential and commercial areas.

Noise Reduction

1. Restrict truck traffic to the hours between 9:00 a.m. and 5:00 p.m.
2. Enclose all pumps and motors in acoustically designed structures.
3. Maintain a berm around all treatment facilities.

Visual

1. Maintain a berm around all treatment facilities.
2. Plant shrubs and trees around treatment facilities.

Project Costs and Impacts on Facilities Users

Cost Comparison of Alternative Plans

Present worth costs have been prepared for each of the alternatives, and are presented in Table 2-20. Alternative A, the County's preferred action, has the lowest total present worth cost - $82,696,000. Alternative C is slightly more than $5,000,000 higher in cost; the other alternatives have much higher present worth costs, ranging from approximately $26,000,000 (Alternative B) to over $40,000,000 (Alternative F) greater than Alternative A.

Table 2-21 provides a Phase I capital and operation and maintenance cost comparison of each alternative. Again, Alternative A has the lowest estimated cost of the six options considered in the CWMP facilities plan.

User Costs

The proposed wastewater projects will be paid for through a combination of financing mechanisms that are still being worked out by the facilities planners. The capital expenditures listed in Table 2-20 will probably be financed with the aid of state and federal grant monies and local funds raised by issuing bonds. The size and source of grant funds is still being investigated. If bonds are issued to pay the county's share of capital costs, these bonds will be repaid by collecting assessments from residents of both the City and County. Operation and maintenance of the new facilities would be funded by charging a monthly fee of all wastewater system users.

In order to provide a user fee comparison of the alternatives, the facilities planners developed the data presented in Table 2-22. These numbers are strictly for comparison purposes. The Phase I capital and operation and maintenance costs were used to develop these numbers; federal and state grant assistance was not taken into consideration and the cost of financing the capital expenditures was not included.

County residents may be faced with two other costs, depending upon their present wastewater facilities. Persons living in County areas served by on-site systems cannot be serviced by the new County wastewater facilities until a local collection system is constructed. These pipe systems will probably be financed by formation of a local improvement district (LID). All property owners within the LID will

Table 2-20. Cost Comparison of Alternative Plans

Alternative	Present Worth		
	Capital	Operation & Maintenance	Total
A	57,525,000	24,171,000	82,696,000
B	83,043,000	25,538,000	108,581,000
C	63,525,000	24,385,000	87,910,000
D	92,609,000	24,751,000	117,360,000
E	86,664,000	28,132,000	114,796,000
F	96,214,000	26,391,000	122,605,000

NOTE: All costs in June 1980 dollars.

SOURCE: Modified from Economic and Engineering Services, Inc., 1980b.

Table 2-21. Phase I Capital and Annual Operation and Maintenance Costs

Plan Alternative	Capital				Annual O&M			
	Treatment	Storage Basins	Interceptors & Pump Sta.	Total	Treatment	Storage Basins	Interceptors & Pump Sta.	Total
A-Regional Treatment @ Central Plant	1,800,000	5,644,000	43,043,000	50,487,000	1,029,000	169,500	263,900	1,198,500
B-Separate Treatment for Spokane Valley	42,000,000	1,014,000	41,123,000	84,137,000	1,000,000	22,000	264,000	1,285,900
C-Separate Treatment for North Spokane	12,740,000	4,630,000	42,762,000	60,132,000	273,000	147,500	263,900	684,400
D-Separate Treatment for Spokane Valley & North Spokane	54,740,000	0	40,842,000	95,582,000	1,473,000	0	264,000	1,736,900
E-Land Application for Spokane Valley & North Spokane	37,400,000	0	58,742,000	96,142,000	1,070,000	0	380,900	1,450,900
F-Land Application for All Areas	33,000,000	4,630,000	70,262,000	107,892,000	1,099,000	147,500	852,900	2,099,400

SOURCE: Economic and Engineering Services, Inc. 1980b.

Table 2-22

PHASE 1
USER CHARGES FOR COUNTY CUSTOMERS

	Alternatives									
	A	B		C		D		E	F	
Monthly User Charge Per Service Connection	All Combined	Spokane Valley	Other Areas	North Spokane	Other Areas	Spokane Valley	North Spokane	All Combined	Spokane Valley	North Spokane
($/mo./service)	$8.56	$10.70	$9.08	$10.75	$7.48	$10.70	$10.75	$9.54	$8.68	$10.62

FOOTNOTES:

(1) These values include both the Project Capital Costs and Operation and Maintenance Costs for only those Phase 1 combinations of interceptor, pumping, equalizing basin, and treatment requirements.

(2) Project Capital Costs do not include the cost of financing the interest charges. They do include Acquisition costs for existing City treatment and conveyance capacities.

(3) Project Capital Costs have been distributed over 30 years into equal annual payments.

(4) Annual O&M values have been estimated only for County residents and include proportionate charges for City treatment based on flow volumes.

(5) All costs are in 1980 dollars.

(6) All facilities, wastewater flows, and service connections have been projected for 1992 - Phase 1 requirements.

(7) Newman Lake and West Plains residents will not be connected into the Phase 1 system and have not been included.

(8) Liberty Lake residents will be paying at least $15.00/month/service as stated in the Liberty Lake 201 Plan.

(9) Costs for collection systems required throughout the County will vary from area to area based on existing versus new development customers, ULID financing provisions, and unique construction costs have, therefore, not been included.

SOURCE: Economic and Engineering Service, Inc. pers. comm.

be assessed a fee to pay for the system. This cost can be paid in a lump sum or over some set time period. The cost per residence can vary considerably depending on development density, ease of construction and a variety of other factors. The facilities planners have developed some estimates of per service costs as follows:

High density development, gravity sewers - $3,233/dwelling
Medium density development, gravity sewers - $4,815/dwelling
Low density development, gravity sewers - $6,665/dwelling
Low density development, pressure sewers - $6,007/dwelling

(SOURCE: Economic and Engineering Services, Inc. 1980b)

Persons living in areas already served by interim facilities with a community collection system will not have to pay this cost. New housing developments in the proposed CWMP service area should be constructed with central collection systems, so this cost would become part of the cost of purchasing a house.

County residents that eventually tie into the new wastewater system through formation of an LID must also pay to connect their house to the collection system. The LID pays only for the pipe out in the street. Homeowners using septic tanks must pay for a pipe from their house out to the street. This cost will vary with the distance from the house to the street and the nature of the house's present plumbing system.

Energy and Chemical Consumption

Most of the CWMP service area is currently receiving wastewater service with only a small chemical and energy input. Septic tank systems and small community treatment facilities use little or no electricity, chlorine or chemical additives. The only major consumer in the area is the City treatment system. Its 44 MGD AWT plant and 19 pump stations require a maximum of about 1,770,000 Kwh of electricity per month to operate (21,240,000 Kwh per year). It is also a large consumer of chemicals, averaging about 18,000 pounds per month chlorine, 134,700 pounds ferric chloride, 445,700 pounds quicklime and 637,300 pounds liquid alum (U. S. EPA 1979). The chemicals are used in phosphorus removal and disinfection processes.

The CWMP facilities planners have estimated the total chemical and energy needs for each of their project alternatives. This includes electrical energy for wastewater conveyance and treatment, heating for digesters and offices, and chemicals for treatment and disinfection. Table 2-23 presents these data.

Table 2-23

ANNUAL ENERGY AND CHEMICAL USAGE - 1992

ALTERNATIVE		ENERGY USE		CHEMICAL USE (Tons/Yr.)	
		Electrical Power (kwh/Yr.)	Heating (mill BTU/Yr.)	Chlorine	Polymer
A	Treatment	11,892,750	2,850	876	14.4
	Pumping	2,648,969			
	Total	14,541,719			
B	Treatment	12,159,500	3,350	857	14.3
	Pumping	3,010,258			
	Total	15,169,758			
C	Treatment	12,068,200	3,200	803	13.7
	Pumping	1,254,741			
	Total	13,322,941			
D	Treatment	12,177,200	2,110	821	13.7
	Pumping	379,490			
	Total	12,556,690			
E	Treatment	12,641,800	2,010	712	12.0
	Pumping	12,467,580			
	Total	25,109,380			
F	Treatment	12,548,200	3,200	803	13.7
	Pumping	38,045,699			
	Total	50,593,899			

SOURCE: Collins, Ryder and Watkins pers. comm.

Alternatives C and D, which provide for secondary treatment and land disposal of North Spokane's wastewater, have the lowest annual electrical requirements. Wastewater pumping demands are much lower than the other options. Alternatives A and B have slightly higher electrical demands because North Spokane flows are pumped to the City plant to go through the activated sludge treatment process. The highest demands are made by Alternatives E and F, which would pump large volumes of wastewater from the valley to the far northwest corner of the County.

The chemical usage, the alternatives with land disposal (Alternatives C, D, E, and F) have the lowest demands. The disinfection required for land disposal is less than that for river discharge, so chlorine needs are less. Also, the amount of wastewater being treated for phosphorus removal is lower, so polymer demands are lower.

Electrical energy supplies appear to be adequate to meet the near-term demands for treatment and conveyance of Spokane County's effluent. Discussions with WWP indicate, however, that by 1983 there are likely to be electrical shortages throughout the northwest. This is due to delays in construction of new thermal power facilities. WWP reviews each new large electrical load request befire authorizing hookup. By 1983, there may have to be a curtailment in large new sources of demand. A monthly energy limit is being made part of each new large load agreement (Washington Water Power Company pers. comm.).

Treatment-related demands on outside energy sources can be kept to a minimum in a variety of ways. The most obvious is to select treatment processes and plant locations that generate the least demand. As mentioned above, Alternatives C and D have the lowest electrical energy requirements. Other actions can also reduce demand. Energy-efficient equipment can be purchased. Methane gas generated during sludge digestion can be used to meet plant natural gas requirements. This is currently being done at the City treatment plant. Chemical dosing can be closely monitored to limit chemical use, thereby indirectly reducing energy consumption.

For those alternatives that include raw sewage storage and flow equalization, pumping to the City plant could be minimized in peak energy demand periods. This would limit the actual peak demand increase resulting from the project.

Chemical use can be kept to a minimum by closely monitoring dosing and using only the amount needed to meet NPDES effluent quality requirements. If alternative disinfection or phosphorus removal methods were used, the need for chlorine and alum might be eliminated, but other resources would probably be used instead. The proposed treatment methods have been recommended by the facilities plan engineers as the most reliable and cost-effective.

Growth Implications

Introduction

This section of the report describes the population growth assumptions used in the facilities plan, compares those assumptions with other local and state population projections, and indicates the type of indirect environmental impact that may result if growth occurs as described in the facilities plan.

Analysis of Facilities Plan Population Projections

Facilities Plan Population Projection Method. The facilities plan population projections are based on projections from the Spokane Areawide Water Quality Management Plan (208 plan). The 208 plan projections, in turn, relied on projections developed in the Metropolitan Spokane Region Water Resources Study (WRS) prepared in 1974 by the U. S. Army Corps of Engineers. Historic growth trends and recent building activity were used to project populations in the WRS.

In 1976 a dwelling unit survey, which was undertaken in conjunction with 208 planning, indicated that the WRS projection in the Spokane Valley had underestimated that area's projected growth. Therefore, an upward revision of the Spokane Valley projection was made. The updated WRS projections are the basis for 208 planning and facilities planning.

For facilities planning, the Spokane metropolitan area is divided into six major geographical areas. These areas are: Spokane Valley, North Spokane, Moran Prairie, Southwest, West Plains, and the City of Spokane. Two of the areas (Spokane Valley and North Spokane) are divided into 10 subunit areas.

The 208 plan projections were calculated on 10-year increments from 1980 to 2020. In the facilities plan, an interpolation of 208 projections to the years 1982, 1992, and 2002 was done. A comparison of facilities plan population projections with 208 projections is presented in Table 2-24.

As shown in Table 2-24, the facilities plan population projections are higher than the 208 plan projections. This appears to be the result of different projection dates which account for approximately 7,000 persons for the year 2000 and planning for different patterns in population distribution.

Table 2-24. Comparison of Spokane Areawide Water Quality Management Plan Population Projections with Comprehensive Wastewater Management Plan Population Projections

	Spokane 208 Plan			Comprehensive Wastewater Management Plan		
	1980	1990	2000	1982	1992	2002
Spokane Valley	84,050	104,270	124,555	84,928[1]	103,738[1]	126,388[1]
North Spokane	26,171	38,561	51,062	26,488[2]	35,634[2]	45,362[2]
Moran Prairie	5,530	7,320	9,298	5,888	7,716	10,028
Southwest	3,088	4,029	4,839	3,276[3]	4,191[3]	5,005[3]
West Plains	2,608	3,074	3,657	948[4]	1,265[4]	1,696[4]
Orchard Prairie	645	707	787	657[3]	723[3]	803[3]
Liberty Lake	NA	NA	NA	4,802	13,393	14,710
Newman Lake	NA	NA	NA	640	840	1,040
Indian Trail	NA	NA	NA	2,157	5,407	9,184
SUBTOTAL	122,092	157,961	194,198	129,784	172,907	214,216
City of Spokane	181,500	188,500	195,500	177,660	180,639	184,073

NA - Not applicable

[1] Excludes Liberty Lake and Newman Lake.
[2] Excludes Indian Trail.
[3] Estimate based on interpolation of 208 plan projections.
[4] Estimate based on interpolation of 208 plan projections, less estimated projections for Airway Heights.

It should be noted from Table 2-24 that projections for Liberty Lake and Newman Lake were included in the 208 projections as part of Spokane Valley subunit 7 and subunit 8, respectively. Similarly, the projection in the 208 plan for Indian Trail is North Spokane's subunit 1. Projections for these areas (Liberty Lake, Newman Lake, and Indian Trail) were prepared independently for purposes of special sewering plans.

Sewered Population. The expected sewered populations in the facility planning area (excluding the City of Spokane) are presented in Table 2-25. The facility plan consultants estimated the future sewered populations by allocating some percentage of future populations from the planning areas.

By 1992, sewer service would be provided to 90,000 persons within the Priority Sewer Service Area. As shown in Table 2-25 only portions of Spokane Valley, North Spokane, and Moran Prairie would be served. The facilities plan consultants have indicated that all new populations will eventually be served and that 80-90 percent of existing populations would also be connected.

By 2002, the sewered population is projected to be 176,050 persons. This accounts for approximately 83 percent of the total 2002 projected population within the facility planning area (GSSA). Based on estimates of future population in the GSSA, approximately 70 percent of the existing population would be served.

Description of Alternative Population Projections

EPA Grant Regulations Relating to Population Projections. In 1978 EPA established regulations for population projections to be used in facilities planning. The projections are to be based on state projections prepared for EPA by the Bureau of Economic Analysis (BEA) of the Department of Commerce in 1977. BEA is the federal agency responsible for most economic forecasting, and is known in particular for its OBERS series of projections, on which the projections prepared for EPA were, in part, based.

EPA has determined that its funding decisions will be based on BEA's state totals, which each state is required to disaggregate to water quality planning areas. In some cases, disaggregation to counties has been made. There are two exceptions to the mandate to use the BEA projections: 1) in the event either a state or a water quality planning area had completed its own population projection prior to June 26, 1978, that projection can be used instead of the BEA-based projection if the state projection does not exceed

Table 2-25. Populations Expected to be Served by CWMP Facilities

Area	1992	2002
North Spokane	26,200	39,350
Spokane Valley	59,950	107,400
Moran Prairie	3,850	6,300
Liberty Lake and Newman Lake		16,500
West Plains		6,500
TOTAL	90,000	176,050

SOURCE: Economic and Engineering Service, Inc. 1980.

by more than 5 percent the BEA state total, and the regional projection does not exceed by more than 10 percent the regional total determined by disaggregating the BEA state projection; or 2) the BEA projection may be appealed to EPA in Washington, D.C.

The BEA Projections. The BEA approach is "top down", based on analysis of the national economy and of each state's economy in relation to the nation as a whole. For all states, including Washington, BEA developed projections for 1980, 1985, 1990, and 2000. Because no adopted Washington state forecast predates June 1978, these BEA projections would normally serve as the basis of EPA funding decisions in the State of Washington.

Status of BEA Projections in the State of Washington. The State of Washington had undertaken its own population forecasting at the time BEA's work for EPA was proceeding, and in August 1979 the state published that forecast. Because the state's forecast deviated sharply from the BEA projection (exceeding the BEA figures by about 20 percent), a resolution of the difference was sought by EPA in order to make clear the basis on which the agency's funding decisions in the State of Washington would rest.

EPA's Region 10 office in Seattle requested from the headquarters office in Washington, D.C. the acceptance of the 1979 state forecast by the Office of Financial Management in lieu of the BEA projection. This request was denied. Instead, EPA's Washington, D.C. office authorized interim use of a forecast based on the BEA projection increased by 10 percent in the year 2000. Table 2-26 presents a comparison of the forecasts mentioned so far: the initial BEA projection, the adjusted BEA projection authorized for EPA use in funding decisions, and the OFM 1979 forecast rejected by EPA for funding purposes. A fourth forecast presented in the table represents OFM's most recent revised state forecast.

The four projections presented in Table 2-26 show a wide range in year 2000 population levels. Only a small amount of this difference is attributable to different 1980 bases; most of it arises from differences in rates of growth. The State of Washington forecast represents about 24 percent more people in the state in the year 2000 than the 4,858,000 level acceptable to EPA.

There has been considerable discussion between EPA and the state about the differences in their forecasts, and EPA has indicated procedures for challenges to the projections EPA has proposed to use for funding decisions. It is not known whether the State of Washington plans further challenges, nor is it yet known how the anticipated publication of new OBERS state projections or the actual 1980 census enumeration (when published) could affect the ultimate population figures applied in EPA's funding decisions.

Table 2-26. Washington State Population Forecasts and Projections (ooos)

	1980	1985	1990	2000
1. BEA 1977 Projection for EPA	3,738	3,908	4,076	4,417
2. BEA Adjusted Projection Approved for Interim EPA Use in Funding Decisions	3,926	4,159	4,392	4,858
3. OFM August 1979 Forecasts	4,036	4,490	4,836	5,345
4. OFM December 1979 Revised Forecasts	4,068	4,619	5,090	6,024

Sources:

1. U. S. Department of Commerce, Bureau of Economic Analysis: *Population, Personal Income and Earnings by State, Projections to 2000*, October 1977.
2. U. S. Environmental Protection Agency, Region X, Craig Partridge, pers. comm., April 2, 1980.
3. Washington, State of, Office of Financial Management: *Recommended Washington State Population Forecasts for Use in Municipal Wastewater Treatment Construction Grants Program*, September 1979.
4. Washington, State of, Office of Financial Management: *State and County Population Forecasts by Age and Sex: 1980-2000* (Special Report No. 30), January 1980.

Projections for Spokane County. Disagreement over future populations is not confined to state-level projections. A lack of agreement over projections at the County level also exists. At present, the EPA-approved state (DOE) projection in Spokane County for the year 2000 is 378,500 persons. As shown in Table 2-27, this projection deviates sharply from most of the other projections. As previously indicated, the projections developed in August 1979 by the Office of Financial Management were rejected by EPA in Washington, D.C.; as a compromise, EPA increased the 1977 BEA projections by 10 percent. The Department of Ecology adopted this revised BEA projection.

The Spokane County Planning Department is currently using the 1977 OFM projection (formerly the Office of Program Planning and Fiscal Management) for year 2000 planning. This projection (376,700 persons) is consistent with the EPA-approved state (DOE) projection for Spokane County. However, the OFM projection is considered by the County planning department to be somewhat low and a revision is expected when final 1980 census figures are available (Hansen pers. comm.).

Based on preliminary 1980 census data, all of the projections in Table 2-27 underestimate the 1980 population in Spokane County. If the recent growth trend continues, the population of Spokane County in the year 2000 will be considerably higher than projected.

Comparison of Facilities Plan Population Projections with Other Projections

It is difficult to compare the facilities plan population projections with other projections since most projections (with the exception of the 208 plan projections) forecast populations for the entire County. In contrast, the facilities plan population projections describe only a portion of the County. To account for the remainder of the County outside of the facility planning area, a 1980 estimate of 50,000 persons has been provided by the Spokane County Planning Department (Spokane County Planning Department pers. comm.). If this population is assumed to increase at a 1 percent annual arithmetic rate, the population in the year 2002 would be 61,000. Added to the 2002 facilities plan projection of 398,300 (including the projection for the City of Spokane in the year 2000) a projection of 459,300 persons in the County for the year 2002 results. This is considerably higher than all other projections with the exception of the December 1979 OFM projection.

In conclusion, the CWMP population projections are higher than 208 plan projections which are supposed to serve as the basis for facility plan projections. In addition, the

Table 2-27. Comparison of Spokane County Population Projections

Projection	1980	1990	2000
Water Resources Study[1] (1974)	315,800	358,500	388,600
Bureau of Economic Analysis[3] (1977)	N/A	N/A	343,700
Office of Program Planning and Fiscal Management[1] (1977)	317,200	355,200	376,700
Office of Financial Management (August 1979)	N/A	N/A	416,400
Office of Financial Management[2] (December 1979)	337,500	399,730	470,330
Department of Ecology[3] (September 1980)	N/A	N/A	378,500
Preliminary 1980 Census[4]	341,058	-	-

SOURCES:

[1] Spokane County Office of County Engineer 1979.

[2] Washington Office of Financial Management pers. comm.

[3] Washington Department of Ecology pers. comm.

[4] Spokane County Planning Department pers. comm.

facilities plan projections, if adjusted for the difference in the geographical area, are significantly higher than most other projections. Discussions with the facilities planners have indicated that the main reason the CWMP numbers are higher is that they were intentionally adjusted upward to account for recent growth trends which were not accounted for in the 208 population projections; also, there is always some uncertainty in estimating the location of future growth, so populations are revised upward slightly to assure that facilities eventually constructed have sufficient capacity to accommodate unexpected patterns of growth. Based on 1980 census data, it appears that growth in the Spokane area is exceeding past projections.

Consistency of the CWMP and County Land Use Planning

Introduction. An essential component of this EIS is an analysis of the extent to which the Spokane County CWMP will induce growth in the Spokane metropolitan area. The location of present and projected residential and industrial land uses will have the most influence on wastewater facilities locations, and conversely, the location of wastewater facilities will exert a significant growth-inducing impact by facilitating opportunities for conversion of agricultural or other open lands to urbanized use. It is, therefore, of the utmost importance that the long- and short-range wastewater facilities plan be compatible and consistent with future land use plans and policies. Also, in cases where several agencies are involved in the planning process, consistency between plans is essential to effective implementation. An analysis, therefore, of the consistency of various plans in the Spokane area is a necessary first step.

The facilities planners for the CWMP developed an existing land use map for the Spokane metropolitan area based on 1976 data provided by the Spokane County Planning Department. Projections for future growth within the area were based primarily upon City and County population projections to the year 2000, plus estimates of population in smaller subunits of the metropolitan area made by the Spokane Metropolitan Area Water Resources Study (U. S. Army Corps of Engineers (1976, Appendix F) and subsequently used in the Spokane County 208 Report (Spokane County Office of County Engineer 1979).

This determination of consistency between the various plans is undertaken in the following sequence:

- A review and description of the latest County Comprehensive Land Use Plan. This is the most important document reflecting policies concerning urban development in the metropolitan area outside of the City of Spokane.

- An evaluation of the subarea population projections of the year 2000 prepared as part of the CWMP for consistency with the County Comprehensive Land Use Plan.

Review of County Comprehensive Land Use Plan. Spokane County has recently held hearings on its latest generalized Comprehensive Plan dated January 1980. This document, which is regarded primarily as a policy document, does not contain any maps, either of existing or future land use, although a large future land use map has been prepared by the planning department to accompany the plan review process. A simplified black and white copy of this map was reproduced in the Draft EIS on the 1980 Comprehensive Land Use Plan issued on August 20, 1980 (Spokane County Planning Department 1980). This has been reproduced as Figure 2-7.

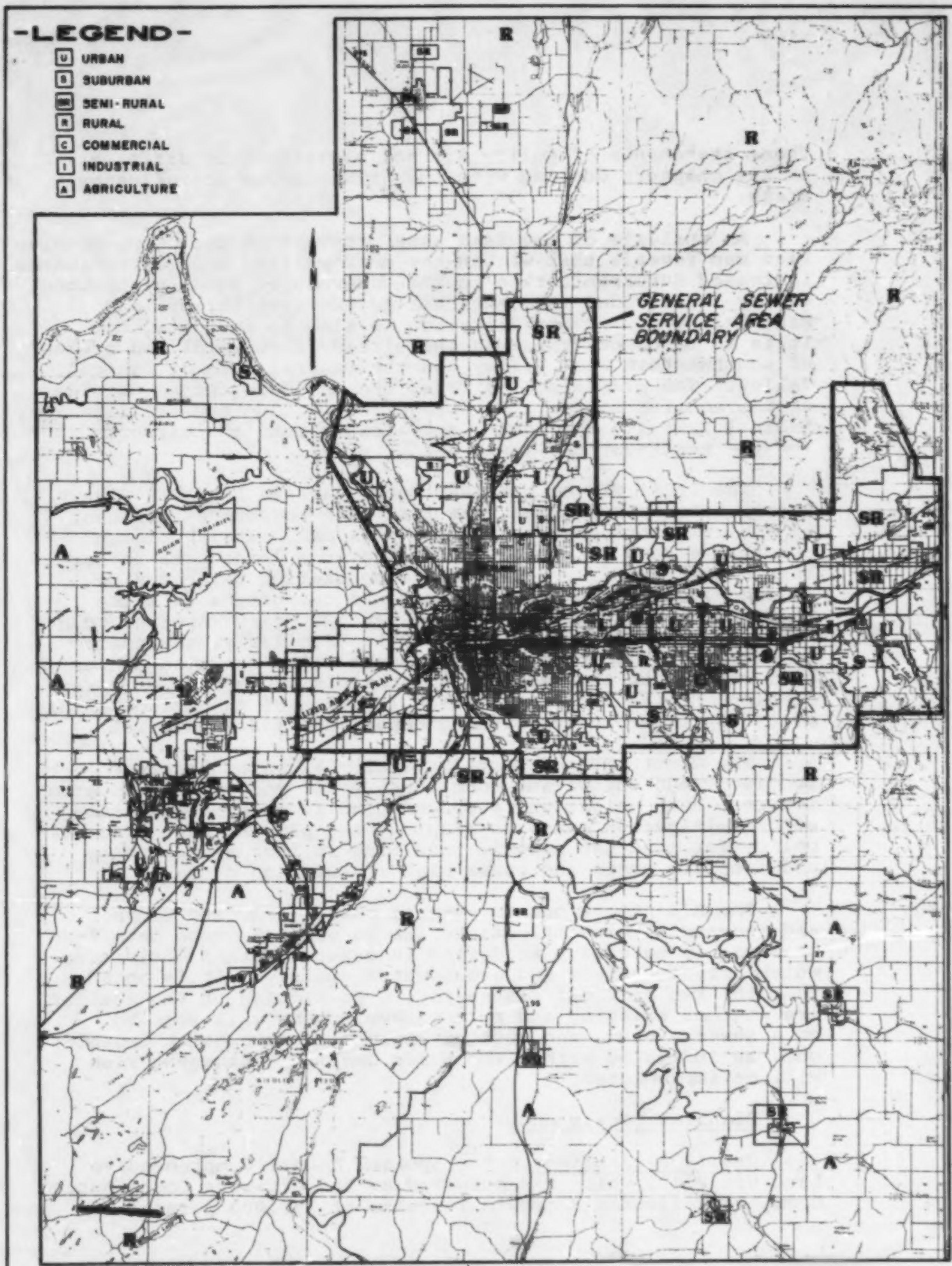
The part of the Comprehensive Plan text which pertains most directly to the area of concern is contained in Chapter 16.0.0, Fringe Study. This section includes planning policy for areas within approximately 1 mile of the Spokane City limits. The fringe area does not include all of the aquifer area east of the City where most of the urban growth is occurring. It also does not include the municipal airport area to the west. Chapter 17.0.0 contains statements regarding Influence Areas around towns and cities in the County. This does include the remaining outer fringes of the CWMP planning area.

The statement of goals and objectives in the Comprehensive Plan text are general regarding land use categories; the principal relevant concerns reflected in most categories are:

1) the containment of sprawl through the filling in within established development areas, where utilities, arterials, schools, and other community facilities have been established;

2) utilities planning should be regional in design, utilizing efficiencies of scale and geographic continuity; and

3) utilities planning should be consistent with the anticipated population growth and developed in coordination with general land use plans.



SOURCE: MODIFIED FROM SPOKANE COUNTY PLANNING DEPARTMENT, 1980

FIGURE 2-7. SPOKANE COUNTY PROPOSED COMPREHENSIVE LAND USE MAP

These statements of policy are not significantly different in the chapters dealing with the fringe areas or influence areas.

An analysis of the land uses proposed on the Comprehensive Plan map reveals that within the metropolitan area it indicates increased suburbanization in the undeveloped lands of Spokane Valley (subdivided into West Valley, Central Valley, and East Valley). Industrialization is also to increase, but it is to be concentrated in the already industrialized areas of southwestern West Valley and the central area of Central Valley. The plan also indicates the following areas outside of the aquifer boundary for urbanization and industrialization: Medical Lake (to the west), and areas around the airport (on the northwest and southwest corners).

The Draft EIS on the 1980 Comprehensive Land Use Plan points out, however, that the text plan objectives will not be achieved through the proposed plan map. It is pointed out that sprawl will be encouraged over a large area rather than concentrated; and the future population which can be accommodated within existing land use categories is twice that which is projected over the next 20 years (Spokane County Planning Department 1980, page 100). Similarly, the policy of encouraging commercial development along existing commercial streets to the east and north tends to further encourage development, as does that of the location of major industrial areas (Spokane County Planning Department 1980, page 101).

The County EIS suggests several mitigation measures to discourage sprawl and concludes, under unavoidable adverse impacts, that unless the proposed plan is changed or recommended mitigation measures adopted, the plan may set a formal policy for land use sprawl, resulting in increased service and facility costs and cause high consumption of land.

The EIS points out in several places that the urban and industrial classifications are so general, more detailed planning is necessary to define in greater detail activities which affect surface and groundwater quality. It is noted that the two critical issues to the protection of the aquifer are whether existing and future development will soon be on a sewer system, and whether stormwater management techniques as indicated within the Water Quality Management Plan will be implemented.

Planning Consistency.

Growth Projections. The Spokane County Comprehensive Land Use Plan, which was prepared by the Citizens Coordinating Committee, assumes a growth increase of 155,000 persons in

Spokane County from 1970-2000. A comparison of this projection with the county planning department's current growth projections and with CWMP growth projections reveals some inconsistency.

The growth projection which accompanies the Comprehensive Land Use Plan was developed on the assumption that 50 percent of all County vacant lands in 1970 would be developed to the lowest designated density within each land use category on the future land use map (Figure 2-7) (Hansen pers. comm.). This resulted in a population increase of 155,000 persons from 1970-2000. According to a County planning department spokesman, the planning department is currently using for long-range planning purposes a population increase of approximately 91,000 persons from 1970-2000 (Hansen pers. comm.). It was further indicated that this 91,000 figure was probably low and that a range from 91,000 persons to 133,000 persons was more reasonable.

The CWMP projects approximately 398,000 persons in the GSSA (including the City of Spokane) in the year 2002. If projections for the areas outside of the GSSA but within the County (50,000 existing population plus 11,000 projected) are added to the CWMP projections, the total County population projection for the year 2002 is 459,000 persons. This represents a projected increase of 171,500 persons from 1970-2002.

In summary, the Spokane County Planning Department is currently projecting an increase between 91,000 persons and 133,000 persons from 1970-2000; the Comprehensive Land Use Plan prepared by the Citizens Coordinating Committee assumes an increase of 155,000 persons from 1970-2000; and the CWMP is based on projections which indicate an increase of approximately 171,500 persons in Spokane County from 1970-2002.

Location and Phasing of Growth. The preceding comparison of growth projections indicates that the CWMP growth projections exceed current growth projections at the County level. The higher growth levels in the CWMP, however, could reflect higher development densities which are not necessarily inconsistent with the Comprehensive Land Use Plan. This is because the comprehensive plan is formulated on land use categories with wide ranges of development density.

As stated, the growth projections for the Comprehensive Land Use Plan were derived on the assumption that 50 percent of all vacant land would be developed by 2000 to the lowest density designated for each land use category (Hansen pers. comm.). The CWMP growth projections were based on 208 projections and, as such, did not follow the comprehensive plan land use pattern. However, the comprehensive plan land use pattern is so general that growth projections twice the magnitude of the comprehensive plan projections could be accommodated and not be inconsistent. The problem with different growth projections, therefore, is not one of inconsistency, but rather of a comprehensive land use plan which, by not containing clear and detailed policies, permits a level of growth much greater than the comprehensive plan growth projections.

On a local level, some potential conflicts between designated land uses in the comprehensive plan and designated service areas in the CWMP are notable. Since extension of sewer service is dependent on development densities in order to be cost-effective, areas designated for low density development (less than 1 unit per 2-3 acres) are generally not considered adequate for sewering. In the Comprehensive Land Use Plan, three land use categories are in the low density development range: agricultural, rural and semirural. The priority sewer service area (PSSA) of the CWMP includes within its boundaries some areas designated as semirural. They are: the Glenrose area, the southern portion of Pleasant Prairie, and the Beacon Hill area. Even though they are within the PSSA, it is unlikely that they will be developed to a density that can support a central wastewater collection system. It therefore might be more appropriate if these areas were left outside the PSSA.

Conclusions. It appears that the Comprehensive Land Use Plan does little to accomplish the following growth management objectives: contain sprawl through fill-in and achieve efficiency in utility and service planning. Vague and general policies concerning development location and phasing encourages the present inefficient sprawl pattern of growth. This poses additional threats to the water quality of the aquifer. The CWMP, which is not intended to be a land use planning or land use policy document, has adopted the spirit of 208 plan recommendations of limiting sprawl by designating a priority sewer service area. This designation and the subsequent construction of Phase I facilities cannot, however, cause the in-fill to occur. It will provide an economic incentive and a utilities framework. More stringent land use control policies by the County are necessary to discourage sprawl over the aquifer. One measure that could help would be to restrict growth within the PSSA until sewers are available in that area, as recommended in the 208 plan. Land outside the PSSA could be restricted to development of less than 5 acres per dwelling unit. This would minimize the population in the unsewered areas until a time when sewer service could be expanded.

Growth-Related Air Quality Impacts

Background. The Clean Air Act (CAA) requires that air quality in the metropolitan Spokane area meet National Ambient Air Quality Standards (NAAQS) by December 1982. EPA has the authority to withhold or condition all federal clean water grants if these standards are not met. Section 316 of the CAA also authorizes a halt of grant funds if the proposed project would accommodate more growth than has been anticipated in the state air quality implementation plan (SIP). It is important, therefore, that population projections used in the SIP and facilities planning efforts be consistent.

Growth rates are used in the SIP to predict changes in air pollutant emissions. With these population and emission data, the necessary amount of pollution reductions are calculated and a pollutant reduction program is developed. If facilities plan population projections exceed SIP projections, it is possible that planned emission reduction strategies will be insufficient to eventually reach the NAAQS air quality goals.

SIP Population Projection. This forecast was developed by the Transportation Study Division of the Spokane Regional Planning Conference (SRPC). The document used in the preparation of the data was Technical Memorandum JB11, which includes information on Spokane area employment, income, and population. The breakdown of the Spokane area using SIP projections can be found in Table 2-28. The projections for 1982 were developed from correlations established with earlier population data, and extrapolated to be consistent with year 2000 estimates (Spokane Regional Planning Conference 1979). Two additional documents used in the SIP were Technical Memorandum JB9, and Employment, Population, Income and other Projections for Spokane County 1975-2000 written by Floyd E. Lauersen (Spokane Regional Planning Conference 1979).

CWMP Projections. A second set of population projections was developed through CWMP wastewater facilities planning efforts. The design of treatment facilities is integrally tied to expected population growth, and the figures developed by facilities planners should correspond to those established in the SIP. The engineering firm of Collins, Ryder and Watkins developed the CWMP population figures.

A geographical breakdown of the "201" CWMP population estimates is shown in Table 2-28. As mentioned earlier, these CWMP figures are based on 208 plan forecasts. The numbers used in the 208 plan are in turn based on projections developed by the U. S. Army Corps of Engineers' (1976) water resources study. Table 2-24 shows the 2-8 plan population data.

Table 2-28. Comparison of State Implementation Plan and Comprehensive Wastewater Management Plan Population Projections

	SIP Projections[1], [4]		CWMP Projections[2], [4]		
Subregion[3]	1982	2000	1980	1990	2000
Spokane Valley	95,920	112,960	84,060	104,270	124,555
North Spokane	33,430	39,176	26,171	38,561	51,062
City of Spokane	179,900	197,400	177,660	180,639	184,073
Peripheral Areas	26,020	30,470	17,313	29,336	34,331
Total	335,270	380,006	305,194	352,806	393,481

[1] Spokane Regional Planning Conference 1979.

[2] Collins, Ryder and Watkins pers. comm.

[3] SIP transportation community populations were aggregated into subregion to approximate those used in the CWMP.

[4] Both projections used 1970 census data as a base.

SIP and CWMP Comparison. Because different geographic units were involved in the preparation of the SIP and CWMP forecasts, SIP transportation communities were combined to approximate the subregions used in the CWMP, namely the Spokane Valley and North Spokane areas.

Geographic boundaries used for the SIP and CWMP population projections are similar but not exactly the same. The total CWMP planning area (GSSA) is smaller than the SIP area. However, the areas that differ are primarily low density and mainly agricultural in use. The difference in area, therefore, should not have a significant effect on population totals. The CWMP and SIP boundaries are shown in Figure 2-8.

In the comparison of the population projections, four main geographic subunits are being used. They are Spokane Valley, North Spokane, City of Spokane, and peripheral areas. The peripheral areas include Moran Prairie, West Plains, Orchard Prairie and Southwest. For consistent projections, the sum total of these areas should be reasonably close.

Another factor to be considered is the use of different time frames for population projections. The 208 projections (the basis for the CWMP projections) are for decade intervals (1980, 1990, 2000). The CWMP planning intervals are 1982, 1992, and 2002. However, there are also CWMP estimates for 1980, 1990, and 2000. The SIP has two time frames; 1982 and 2000. A correction factor can be applied to the 1982 data to allow a comparison with the 1980 numbers.

Analysis of the projections in Table 2-28 shows that some discrepancies do exist. In the Spokane Valley area, the CWMP projections are higher than the SIP projections. The CWMP has anticipated a greater population increase than was used in preparing the SIP. The probable reason for this discrepancy is that the 208 projection was updated after the 1976 water resources study. This revision showed that the percentage of new development in Spokane Valley had increased significantly. The facility planners then based their projections on the revised Spokane Valley figure.

The year 2000 population projections for the SIP and CWMP plans are not identical, but their difference amounts to only 3.4 percent. The population projections used for both the SIP and the CWMP were prepared from 1970 base data. While the two projections are very similar in terms of long-term projections (year 2000 or 2002), they show significant differences for a short-term time frame (1980 or 1982). The SIP has predicted a much more rapid short-term growth in all subregions. After 1982, the SIP predicts a slower rate of growth than the CWMP. If the growth were to occur as predicted in the CWMP, attainment of NAAQS might occur sooner than predicted in the SIP.

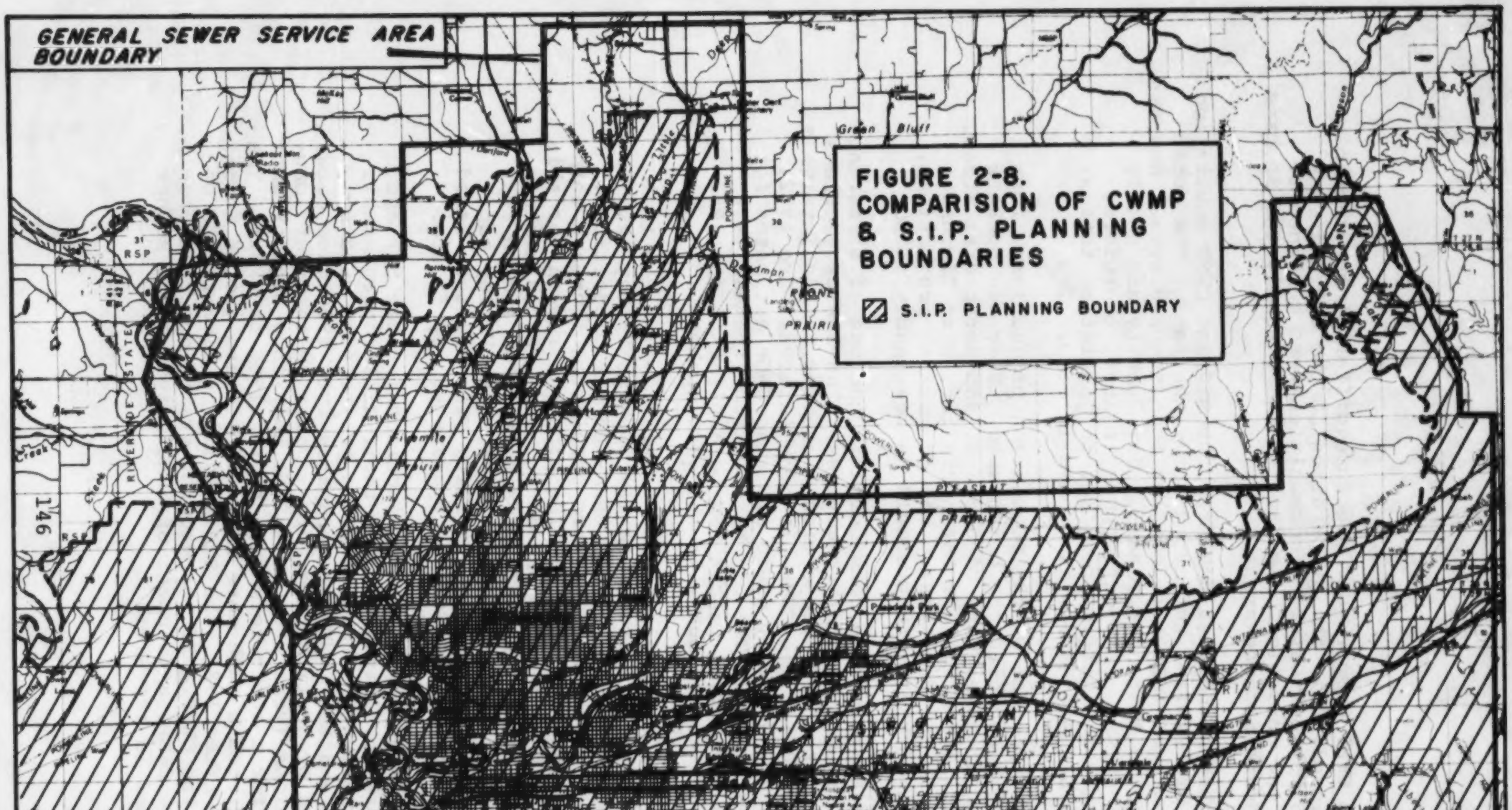


FIGURE 2-8.
COMPARISION OF CWMP
& S.I.P. PLANNING
BOUNDARIES

▨ S.I.P. PLANNING BOUNDARY

The biggest difference between the two forecasts is the internal distribution of growth. The CWMP predicts a much larger population in Spokane Valley and North Spokane, but a smaller population in the City of Spokane. The location of growth will have a significant effect on CO problems, because CO levels are dictated by traffic patterns. High volume, low speed traffic is indicative of potential CO problems. If the distribution of growth occurs as predicted in the CWMP, CO problems in the Spokane Valley and North Spokane areas could be more severe than anticipated by the SIP analysis. The SIP did not analyze alternative growth patterns for potential CO problems, however, so any conclusions in this regard would be speculative.

Conclusions. As population increases in the Spokane area, there could be a proportional rise in carbon monoxide and particulate emissions. This has a direct relationship with the number of motor vehicles, the principal source of these pollutants. If there were a significant difference between the SIP and CWMP population projections, it would result in different estimations of these air pollutant levels. A carefully planned pollution reduction program has been initiated to help Spokane attain NAAQS using the SIP populations. An over-estimation of population could enact a program that is more intensive (and expensive) than necessary. Conversely, an underestimation of population would produce a program that might not reduce CO and particulate levels to the point of meeting NAAQS.

The CWMP and SIP population bases are not significantly different in the 20-year time frame used for facilities planning. The CWMP predicts less short-term growth than the SIP. Considering that the local air quality improvement plan and the SIP were developed using higher short-term population numbers and still predict attainment of NAAQS by 1983, the CWMP does not appear to conflict with efforts to achieve the 1983 standards. Appendix A describes in detail the present and predicted air quality situation in Spokane and the attainment strategies of the SIP. The differences in distribution of growth predicted in the SIP and the CWMP, however, could have some influence on the effectiveness of some of the mitigation strategies contained in the SIP.

Water Quality

The conversion of land to industrial, commercial and residential uses can increase water quality problems as well as problems with water supply. The two most obvious concerns are increased urban runoff and soil erosion. As agricultural or undeveloped land is covered by buildings and pavement, the amount of precipitation that runs off as overland flow increases. Oil and grease and the wide variety of chemicals that are used around dwellings are carried in greater quantities into storm drains and surface waters. Where soils have been disturbed during construction, the heavier runoff carries soil and silt with it; this affects both the quality of surface waters and their value as wildlife habitat. Most urban runoff enters storm drains or natural drainageways; it therefore passes untreated into the surface and groundwaters.

Control of urban runoff received considerable attention in the Spokane County 208 study. A separate task report was prepared to describe urban runoff characteristics and establish pollutant loading rates appropriate for the Spokane area (Spokane County Office of County Engineer 1979a). Esvelt's (1978) Cause and Effect Report suggested that increasing urbanization over the Spokane Valley Aquifer was a serious threat to Spokane's water supply unless control measures were developed and enforced. As a result, the final 208 plan included a number of urban runoff control recommendations. These are listed on pages 65-68 of the Spokane Aquifer Water Quality Management Plan (Spokane County Office of County Engineer 1979) and are included in Appendix C of this report.

The Spokane County CWMP predicts a population increase of 52,842 in the GSSA by 1992 and another increase of 41,301 between 1992 and 2002. The density and location of this added population cannot be predicted exactly, but based on the County Comprehensive Land Use Plan and the population breakdowns provided by the wastewater facilities planners, most is expected to locate in Spokane Valley and North Spokane. These areas are over the aquifer, so the runoff from the newly urbanized lands is of concern.

Table 2-38 lists the numbers of new housing units expected within the GSSA in the next 20 years. A total of 36,459 new households are expected by 2002. The County Comprehensive Land Use Plan allows for residential densities ranging from 17 units per acre to less than 1 unit per acre within the GSSA. The average density for the plan's urban land use category is about three dwelling units per acre. The County 208 plan also used three units per acre to estimate urban runoff waste loads. If the three unit per acre figure is used, the 36,459 new households would generate 12,153 new urban acres within the GSSA by 2002. A rough estimate of the increased pollutant loadings from this residential acreage can be gained by multiplying the loading factors in Table 2-29 by this new acreage total.

No estimate has been made of the commercial or industrial development to be sewered by the CWMP. Table 2-11 lists the facilities planner's estimates of industrial flows to be accommodated by CWMP wastewater system, but the size, location and type of industry has not been specified. The Comprehensive Land Use Plan anticipates further industrialization in the central portion of Spokane Valley. With rapid residential development in the valley and North Spokane, the commercial acreage is also likely to concentrate in these areas. Table 2-29 lists typical runoff waste loads from these land use types.

The waste loads in urban runoff can be just as damaging to surface and groundwaters as sanitary wastes if not properly managed. A domestic waste and urban runoff comparison contained in a 208 plan task report stated that domestic wastes have the greatest potential impact in terms of nutrients and dissolved solids. Urban runoff has a greater potential for metals contamination (Spokane County Office of County Engineer 1979a). Table 2-30, presents the 208 comparison. The metals, solvents, herbicides, pesticides, and numerous other chemical compounds that are frequently found in runoff from urban areas may be just as significant a threat to Spokane's drinking water supply as sanitary wastes considering the extent of development planned over the aquifer east of the city.

The CWMP deals only with the sanitary waste problem. It does not include recommendations for urban runoff control. The 208 plan provides guidance for rectifying present urban runoff problems and reducing problems that might occur from further development over the Spokane Valley Aquifer. The 208 control strategies are included in Appendix C. They include methods to maximize collection and land treatment of runoff from existing development and a framework for requiring new developments to include urban runoff control facilities. There should be a continuing effort to implement the 208 control measures so that urban runoff from development served by the CWMP does not further threaten the beneficial uses of the Spokane River and the Spokane Valley Aquifer.

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Table 2-29. Relative Contaminant Loading (sanitary waste load per runoff load)[1]

	Total Dissolved Solids	BOD_5	Total Nitrogen	Nitrate-Nitrogen	Total Phosphorus	Ortho-Phosphate	Chloride	Sulfate	Sodium	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Pesticides	Complex Organics	Total Coliform	Fecal Coliform
Open Space	58	51	30	46		49	457			$6x10^5$	$5x10^4$		30	256					$8x10^3$	$2x10^4$
Residential	4.9	5.1	9.5	14.1	3.6	8.6	32.6			3.0	0.17	0.45	0.03	1.9	0.73				31	33
Commercial	1.0	2.5	4.3	3.9	2.3	4.8	21.7			3.0	0.11	0.58	0.02	2.0	0.85				47	46
Industrial	1.1	1.2	4.7	6.3		2.3	18.5			0.8	0.04	0.17	0.02	1.8	0.03				27	13
Average	2.7	3.7	7.9	9.8	3.1	3.1	29.8	2.0	40	2.8	0.12	0.52	0.03	1.8	0.69	0.003	0.28	0.59	32	32

[1] Typical "per acre" sanitary waste loads have been divided by urban runoff waste loads. Numbers greater than 1 indicate a higher relative sanitary waste load; numbers less than 1 indicate a higher relative urban runoff waste load (example, the sanitary waste load of BOD_5 from an acre of residential land is 5.1 times greater than the load carried in urban runoff from an acre of residential land).

SOURCE: Spokane County Office of County Engineer 1979a.

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Table 2-30. Areal Runoff Loading Rates Selected for Spokane
(lbs/acre/yr)

	Percent of Developed Area	Total Suspended Solids	Total Dissolved Solids	BOD_5	COD	Total Nitrogen	Nitrate-Nitrogen	Total Phosphorus	Ortho-Phosphate	Chloride	Sulfate	Sodium	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Pesticides	Poly Chlorinated Biphenyl[1]	Oil & Grease	Total Coliform[1]	Fecal Coliform[1]	Complex Organics
Open Space		75	10	5	25	1.5	0.4		0.3	0.3			5×10^{-5}	4×10^{-6}		1×10^{-3}		2×10^{-3}					6×10^{9}	3×10^{8}	
Residential	56	400	120	50	200	4.8	1.3	4.1	1.7	4.2			0.006	0.4	0.19	2.9	0.06	0.7					1.6×10^{12}	1.5×10^{11}	
Commercial	34	800	200	70	300	3.5	1.6	2.1	1.0	2.1			0.002	0.2	0.06	1.5	0.02	0.2					3.6×10^{11}	3.7×10^{10}	
Light Industrial	2	800	200	70	400	3.4	0.8	ND	2.0	2.1			0.01	0.42	0.20	0.5	0.06	0.6					1.5×10^{12}	1.1×10^{11}	
Heavy Industrial	8	400	100	40	300	1.8	0.6	ND	1.3	1.4			0.004	0.3	0.11	1.2	0.04	0.3					3.9×10^{11}	8.6×10^{10}	
Weighted Ave[2]		545	150	57	246	4.0	1.3	3.3	1.5	3.2	25	3.0	0.0046	0.40	0.14	2.2	0.04	0.5	0.1	0.4	0.01	12	1.1×10^{12}	1.1×10^{11}	0.8
WWS[3]		500		50	240	4.5	0.6		1.0							0.5		0.6							

[1] Number/acre/year.
[2] Values for Residential, Commercial, Light Industrial and Heavy Industrial weighted by percent of total developed.
[3] Reference 9.

SOURCE: Spokane County Office of County Engineer 1979a.

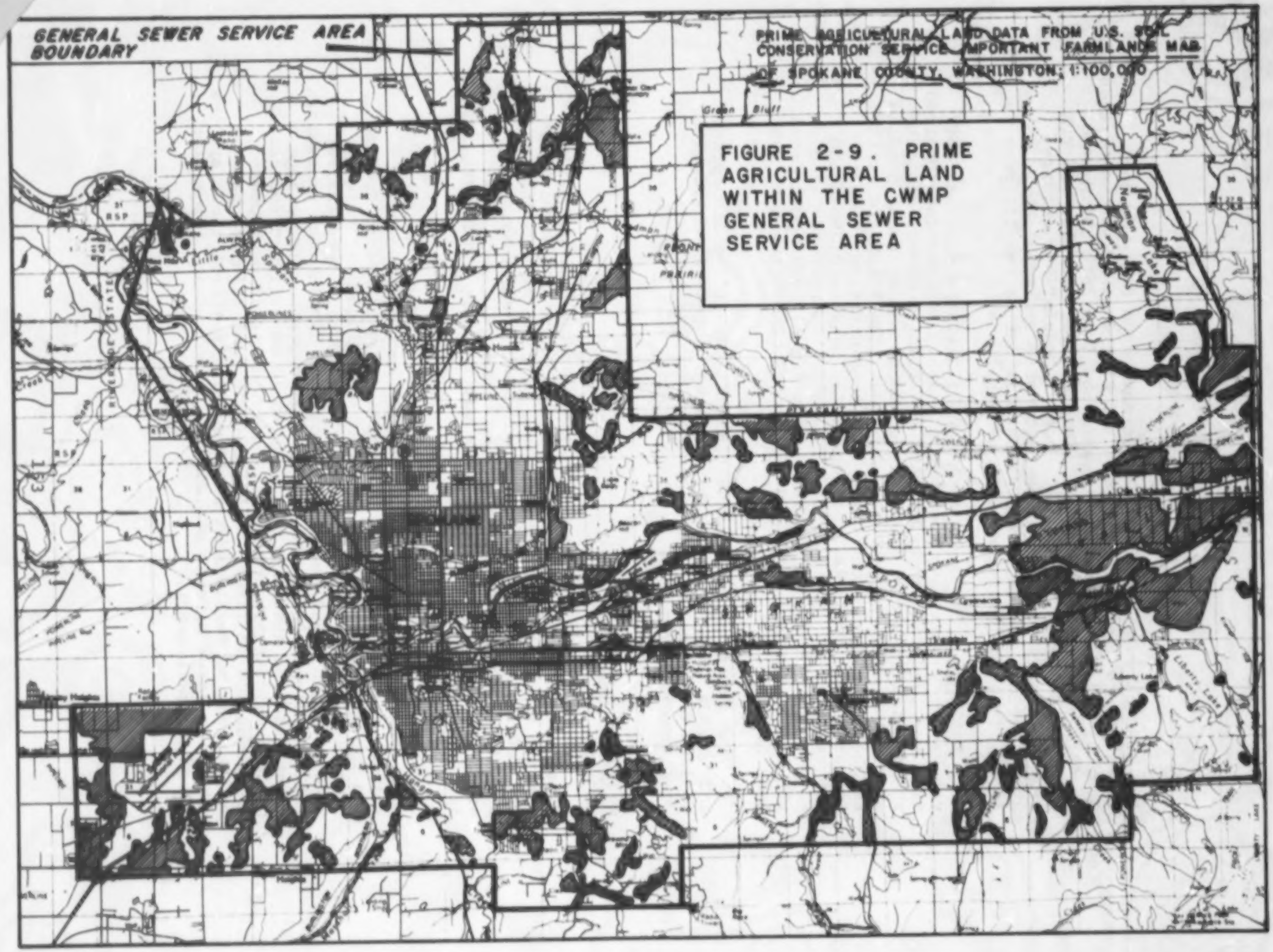
Agricultural Lands, Wetlands, and Floodplains

This section discusses the potential for loss of agricultural lands, wetlands, and floodplains from urbanization. Steady growth has occurred in the unincorporated lands around Spokane and this trend is expected to continue. The facilities planners have delineated a 20-year wastewater service boundary (General Sewer Service Area) for the Spokane area in response to the growth pattern being predicted by the Spokane County Planning Department (see Figure 2). This growth will be supplied wastewater service by the proposed CWMP facilities. The following paragraphs describe those prime agricultural lands, wetlands, and floodplains within the 20-year wastewater service boundary that might be lost if the development pattern occurs as the County predicts.

Agricultural Lands. Prime agricultural land, as designated by the U. S. Soil Conservation Service (SCS), covers a considerable acreage of the General Sewer Service Area (GSSA) (see Figure 2-9). Much of this prime agricultural land is presently under production. Wheat is the most important crop. In recent years, an average of 3,000 acres of agricultural land has been lost to other uses annually in Spokane County. Twenty-five percent is prime agricultural land (Spokane County Planning Department 1980). Continued agricultural production is further jeopardized by anticipated growth accommodated by the wastewater facility expansion. The areas that will be affected most are: 1) Five Mile Prairie, which is classified as having excellent crop potential by the SCS; 2) the area around the Spokane Municipal Airport; and 3) the Spokane Valley. Around Otis Orchards, the land is designated prime agricultural land because of its high irrigation potential (Spokane County Planning Department 1980).

A number of mitigation measures could be considered to protect farmland from future development. These include: 1) preferential property tax assessments; 2) purchase of development rights; 3) agricultural districting; 4) transfer of development rights; 5) stricter state or federal control of prime agricultural land development; and 6) County Comprehensive Plan revision, directing growth away from prime agricultural land.

Floodplains. There should be no significant development of floodplains as a result of CWMP implementation. Certain areas along the Spokane and Little Spokane Rivers and Hangman Creek are within the 100-year floodplain (see U. S. Federal Insurance Administration [FIA] Flood Insurance Maps - Community Panel Nos. 530183 0001-0019). There are additional areas distant from the streams where flooding occurs. These include



PRIME AGRICULTURAL LAND DATA FROM U.S. SOIL CONSERVATION SERVICE IMPORTANT FARMLANDS MAP OF SPOKANE COUNTY, WASHINGTON, 1:100,000

FIGURE 2-9. PRIME AGRICULTURAL LAND WITHIN THE CWMP GENERAL SEWER SERVICE AREA

the area between 29th and 55th Streets from Perry Street to Pittsburg, between Pittsburg and Florida from 4th to Martson Avenue, and a northwest-southeast band from 36th and Myrtle to 49th and Crestline Street. For specific details, see FIA maps 530183 0014A and 0005A. Federal regulations require that buildings in these areas be constructed so as to avoid serious damage or health hazards during the 100-year flood if flood insurance is to be available.

Wetlands. The U. S. Fish and Wildlife Service has not yet mapped wetlands in Washington State. Information obtained from the 1980 Comprehensive Land Use Plan, however, indicates there are a number of areas of permanent and seasonal ponding within the proposed CWMP service area. The sites are scattered throughout the area but there is a concentration in east Spokane, including the Trentwood area, between Dishman and Opportunity, and south of the interstate fairground. The only other significant wetland areas are along Hangman Creek, the Little Spokane River and the shores of Liberty Lake and Long Lake.

The County Comprehensive Plan has identified floodprone and ponded areas because they represent physical restrictions to land development. The comprehensive plan discourages development within these wetland areas.

Wildlife and Vegetation

Under the no-action alternative growth (and population density) is likely to be less, as only those areas suitable for the use of septic systems would be developed in the future. The scenario for residential development would probably be one of "clustered" residential and commercial uses, with areas of steep slopes, high groundwater or impermeable soils left undeveloped.

For each of the project alternatives (A through F), more land within the wastewater management area would be available for development, particularly in the North Spokane and Spokane Valley areas. Those areas defined as "unique flora and fauna" areas in the Spokane County Comprehensive Land Use Plan (1980) may be subjected to development pressures and undeveloped lands now supporting Ponderosa pine/steppe vegetation and attendant wildlife would be utilized for continued residential, commercial, and industrial development. The reduction of large, contiguous areas of wildlife habitat by encroaching development would adversely affect those species requiring large parcels of land (i.e., mule deer, black bear, and white-tail deer).

Habitat for some game birds has already been considerably reduced by development (both residential and agricultural), most notably ring-neck pheasant and Hungarian partridge (U. S. EPA 1979). This trend of habitat loss is likely to continue.

Public Services

An analysis of Spokane County's public service system was recently done in the EIS on Spokane County's 1980 Comprehensive Land Use Plan. The information below summarizes Spokane County's EIS analysis of key public services and evaluates the potential impact of growth (as projected in the CWMP) on public services. In addition, mitigation measures are discussed.

Schools.

Existing Conditions. Spokane County is served by 16 school districts (Figure 2-10). Included within the facility planning area (GSSA) is the City of Spokane School District (District 81) and portions of the following school districts: West Valley (District 363), East Valley (District 361), Central Valley (District 356), Cheney (District 360), Nine Mile (District 325), Mead (District 354), Orchard Prairie (District 123), and Great Northern (District 312).

Enrollment figures for the districts in the facility planning area are presented in Table 2-31. The existing capacity of the facilities is also presented.

Potential Impact of Growth. Based on projected populations in the facilities plan, the Spokane Valley school districts (Districts 356, 361, and 363) will be most impacted. The Central Valley School District, which reached capacity at all levels during the 1978-1979 school year, has made plans for new facilities to relieve existing capacity problems. At present, West Valley and East Valley School Districts have some additional capacity. The Mead School District (District 354) has additional capacity, but the district is expected to exceed this capacity in the near future. The Nine Mile Falls District (District 325) has already exceeded its capacity and additional growth in the area would likely have significant impacts. Anticipated development in the Moran Prairie area is expected to impact the City of Spokane's school district.

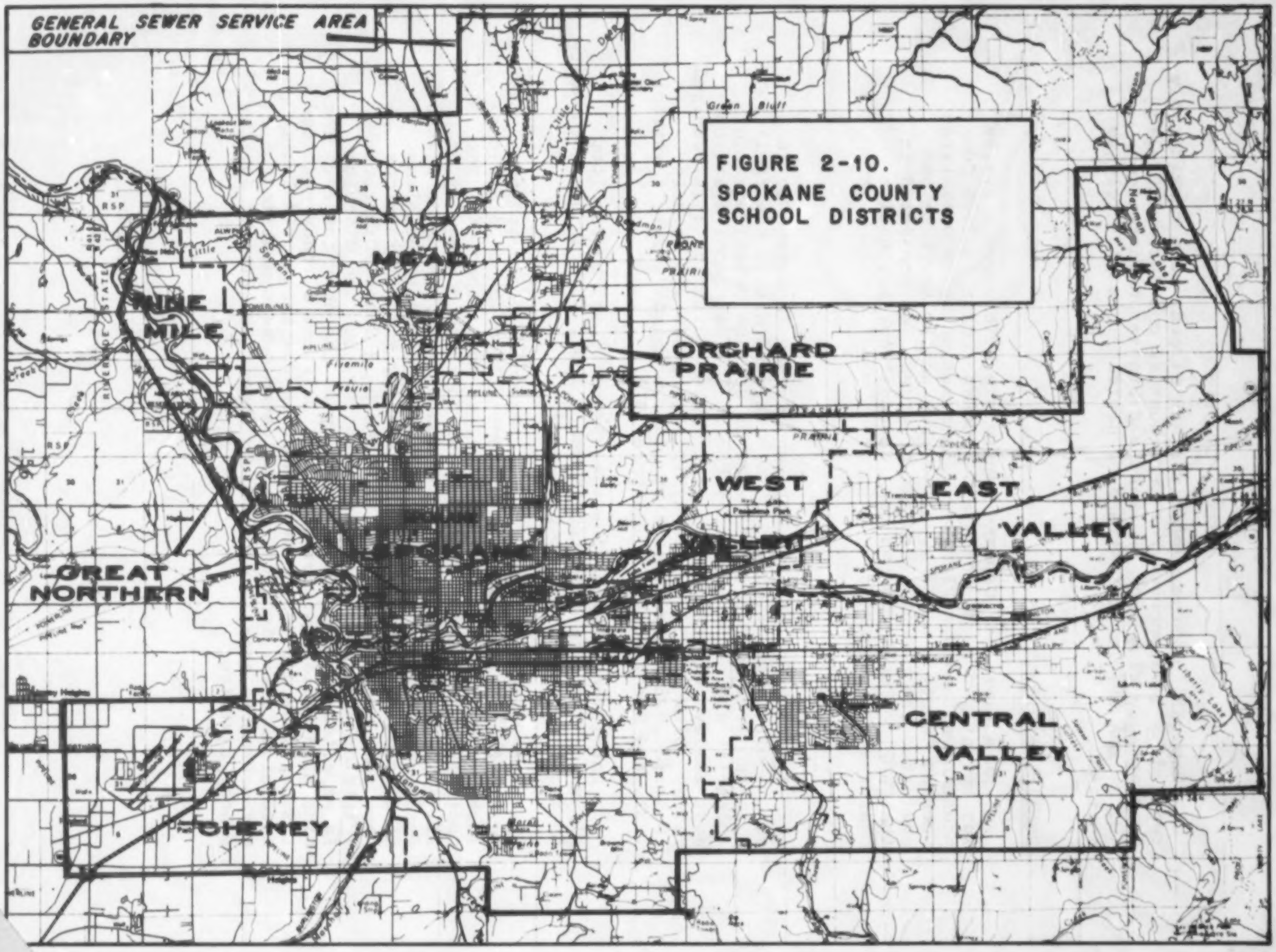


FIGURE 2-10.
SPOKANE COUNTY
SCHOOL DISTRICTS

Table 2-31. Enrollment and Capacity for Spokane County School Districts 1976-1979 (rounded to the nearest whole number)

District	Grades	1976-1977	1977-1978	1978-1979	Capacity
Spokane	1-6	13,504	13,757	13,407	14,000
	7-8	4,614	5,077	4,267	5,240
	9-12	10,107	10,119	9,488	7,840
Orchard Prairie	1-6	35	37	38	
	7-8	7	11	8	70
Great Northern	1-6	22	22	25	50
Nine Mile Falls	1-6	256	196	337	250
	7-8	80	68	98	70
Medical Lake	1-6	989	1,025	993	1,510
	7-8	346	367	316	460
	9-12	666	658	639	750
Mead	1-6	2,522	2,319	2,660	4,000
	7-8	927	925	856	1,800
	9-12	1,855	1,698	1,978	1,700
Central Valley	1-6	5,085	4,757	5,286	5,100
	7-8	1,687	1,762	1,669	1,500
	9-12	3,491	3,371	3,478	3,400
Freeman	1-6	315	302	330	
	7-8	101	105	110	400
	9-12	209	216	214	300
Cheney	1-6	1,526	1,525	1,535	2,021
	7-8	514	528	514	1,000
	9-12	1,061	1,025	1,034	987
East Valley	1-6	1,519	1,379	1,663	2,000
	7-8	477	468	446	1,400
	9-12	824	806	873	750
Liberty	1-6	240	237	265	
	7-8	78	88	91	500
	9-12	172	176	184	225
West Valley	1-6	1,359	1,379	1,305	2,090
	7-8	532	605	468	1,080
	9-12	1,235	1,238	1,224	1,050
Deer Park	1-6	670	661	701	1,020
	7-8	298	288	278	450
	9-12	608	555	589	675
Riverside	1-6	639	592	662	540
	7-8	239	218	250	500
	9-12	419	393	447	500

SOURCE: Spokane County Planning Department 1980.

Police.

Existing Conditions. Police protection in the facility planning area is provided by the City of Spokane and the County Sheriff Department. Within the County, 11 major sheriff districts recently have been developed as a means to improve response time. Five of the 11 districts are located in Spokane Valley. Five officers and one patrol car are necessary to provide protection to each district over a 24-hour period.

Response time varies according to the type of incident and according to the size of the district. In general, the farther the incident is from the City of Spokane, the longer is the response time. Response time ranges between 2-3 minutes in Districts 1-4 and 10-20 minutes in Districts 9-11.

Assessment of the present capabilities to provide additional police protection is to a large extent dependent on where future populations will locate and the composition of new residents.

Potential Impact of Growth. As projected in the facilities plan, more population will occur in the Spokane Valley area than in any other area. This concentration of population in the Spokane Valley is consistent with the County Sheriff's districting efforts. The impact which significant population increases will have on other districts is less certain. Projected population increases in North Spokane will likely necessitate some redistricting to maintain the current level of service.

Fire.

Existing Conditions. Fire protection within Spokane County is provided by 12 districts. The heaviest concentration of fire stations occurs in Fire Districts 1, 9, and 10, adjacent to the City of Spokane. Fire insurance ratings for fire districts within Spokane County vary within the districts based on the fire protection equipment available, water availability, the number of hydrants, and other similar factors. The City of Spokane has the highest rating and the outlying areas of the County have the lowest.

As a rule, the fire districts do not equip for future population needs but respond to existing population needs. As improvements in equipment and programs occur, requests to upgrade fire insurance ratings are made.

Potential Impact of Growth. Based on the population projections in the facilities plan, most growth will occur in District 1 and District 9. This could significantly impact the ability of the districts to maintain existing levels of service. In addition, projected growth in the Moran Prairie area could reduce the existing level of service in District 8.

In general, most population is projected to occur in areas which currently have a high level of fire protection. Some growth, however, will likely occur in areas where fire protection service is poor.

Water Supply.

Existing Conditions. Most of the domestic water supply in Spokane County comes from underground sources. The largest underground source of water within the County is the Rathdrum Prairie Aquifer. This source has been designated by EPA as a "sole source" water supply for the Spokane-Coeur d'Alene area.

In the County, water is supplied by one of the following systems: municipal water system, a water cooperative, a private well or water system, irrigation water districts or large industrial systems. The percentage of the County's population in 1976 serviced by the different types of water supply systems is presented in Table 2-32.

In the past several years, the County has been engaged in developing a coordinated water supply plan. The main purpose of the plan is to reduce the confusion, conflicts, and excess costs associated with the multiplicity of water systems. Basically, the plan designates critical water supply service areas in an effort to coordinate water supply planning. A detailed account of the water supply planning procedure can be found in Volume 1, Spokane County Coordinated Water Systems Plan (Economic and Engineering Services, Inc. 1980c).

Potential Impacts of Growth. Based on the projected populations in the facilities plan, demand for water supply will occur primarily in Spokane Valley and North Spokane. Since it is estimated that only 20 percent of the aquifer source is currently utilized it appears that adequate water supplies are available (Spokane County Planning Department 1980). The development of additional water supply delivery systems in the Spokane Valley and North Spokane will be needed to handle future development.

Transportation System.

Existing Conditions. The only designated freeway in the facility planning area is Interstate 90 which runs east-west through the City of Spokane. Other major highways which

Table 2-32. Water Supply Systems in Spokane County in 1976 and the Percentage of County Population Served

Number and Type of Water Supply Systems	Percent of County Population Served
10 Municipal Water Systems	65
5 Special Water Districts	5
7 Water Cooperatives	1
8 Private Water Companies	13
11 Irrigation Districts	14
Others	2
TOTAL	100

SOURCE: Spokane County Planning Department 1980.

provide interregional access include: 1) State Route 2, which travels to the west and north of the City of Spokane; 2) State Route 395, which serves areas north of the City of Spokane; and 3) State Route 195, which runs south out of the City of Spokane.

The County of Spokane Road Department is responsible for road maintenance and improvements in the facility planning area. A program for road improvements in the County is included in the 1980-1985 6-year transportation improvement program.

Potential Impact of Growth. Based on population projections in the facilities plan, the existing road system in the Spokane Valley area will be significantly impacted unless major additions in road service are provided. With no north-south highway in the Spokane Valley, traffic congestion commonly occurs. This situation will likely be further compounded by additional growth. The projected population in North Spokane will require considerable road improvement in that area. The development of additional major arterials will likely be needed to service the North Spokane area.

Recreation.

Existing Conditions. Spokane County Parks and Recreation Department is the responsible agency for park and recreational facility planning. As stated in the Spokane County Park Plan, the objective of providing recreational land is based on a ratio of 1 acre per 100 persons. In most areas of Spokane County (based on planning unit areas), however, the recreational land to population ratio is less than half of the stated objective. One area which is especially deficient is the West Spokane Valley area. Although recreational land deficiencies exist in most parts of Spokane County, the numerous lakes and rivers in the area provide additional recreational opportunities.

Potential Impact of Growth. The projected population in the facility planning area can be expected to place significant demands on existing recreational facilities, especially in Spokane Valley and North Spokane. The projected population increase will result in more crowded conditions at most facilities. Impacts on specific facilities have not been determined.

Solid Waste.

Existing Conditions. Solid waste in Spokane County is currently disposed of at one of the following sites: five sanitary landfills, five sewage disposal sites, three drop boxes (the contents of which are dumped in the sanitary landfill), and one special waste site at Kaiser aluminum plant. It is estimated by the Spokane County Health Department that 90 percent of all solid waste is dumped in sanitary landfills (Spokane County Planning Department 1980). The two City-operated landfills handle about 70 percent of the total County solid waste. An update of the Countywide solid waste plan is currently under preparation.

Potential Impact of Growth. Based on estimates of the current rate of solid waste disposal, the five existing County landfills will reach capacity in approximately 12 years. Significant increases in population (as projected in the facilities plan), however, will result in capacity being reached much sooner.

Mitigation Measures. In an effort to coordinate growth and the provision of public services, local agencies within the facilities planning area have developed public services plans and policies. To the extent that these plans and policies are implemented, the potential adverse impacts of growth on public services will be mitigated.

If public services plans and policies are not implemented, local service deficiencies could result, but these are unlikely to be of sufficient magnitude to affect the growth rate of the facilities planning area. At this time, development of additional mitigation measures related to public services does not appear warranted as part of this EIS.

Electricity and Gas

Continued rapid growth in the Spokane area will require additional use and consumption of electricity and natural gas resources. According to the Washington Water Power Company (WWP), the principal supplier of electricity and natural gas to eastern Washington and northern Idaho, electrical supplies have been critically short in the past and this trend is expected to continue. The demand for electricity is increasing but generation capacity is not. No new power plants are expected to be operating before 1983. In 1983, the Washington Nuclear Project No. 1 is expected to be generating electricity. Other plants are not anticipated to be in operation until the latter half of the decade. Most of the present electric supply originates from hydroelectric plants; therefore, in drought years there has been a serious reduction in generation capacity (Witter pers. comm.).

Discussions with staff at WWP indicate that the power situation in the region could be critical by 1983 because of delays in approval and construction of new power plants. WWP has a large load request system to handle any new customers requiring large quantities of power. Requests are reviewed on an individual basis before a decision is made regarding hook-ups. Management approval is necessary preceding all new hook-ups. By 1983, however, there may have to be a curtailment of this type of hook-up or power shortages may occur, especially in dry years. WWP is now requiring an energy limit as part of the hook-up agreement; a specified number of kilowatt hours (Kwh) per month is used.

Approximately 70-75 percent of natural gas for use in the Spokane area is supplied by Canada; the remainder originates in the Rocky Mountains. Gas supplies are adequate and availability is good. The individual demand for gas has decreased in recent years since gas is more expensive than electricity and since gas systems are more difficult to install. WWP policy encourages both the use of gas in new developments and the conversion from electricity to natural gas in existing residences.

According to WWP's 1979 annual report, the average annual consumption rate of electricity and gas in the service area was 15,763 Kwh per household and 1,195 therms per household, respectively. Assuming these average annual consumption rates remain constant, the projected increase of 36,459 households for the GSSA area between the years 1980 and 2002, would require an additional 574,700,000 Kwh of electricity and 43,568,500 therms of gas annually by 2002. On an averaged annual basis, these figures represent yearly increases of 26,122,700 Kwh of electricity and 1,980,400 therms of gas.

The potential impacts on energy supplies can be controlled to a degree by initiating simple conservation-oriented planning policies on a local scale. This could include incorporating energy conservation requirements into building codes, publicizing household-oriented energy and resource conservation techniques in schools and through the local media, and conducting local energy education campaigns. Energy fairs and workshops have proven to be valuable in disseminating conservation information that can reduce demand and save consumers dollars on utility bills.

Influence on the Local Economy

The impact of the project on the local economy will be its influence on the growth and character of employment and other economic activities. The amount of influence - the impact - will be the difference between the amount and type of growth with the project and the amount and type of growth without it.

Economic Setting

The Economic Region. Spokane County is located in the midst of a trading area known as the Inland Empire, a region comprised of 36 counties in eastern Washington, northern Oregon, northern Idaho and western Montana. The economy of the region is based on agriculture, including crop production, livestock and food processing; mining, which focuses on silver, lead and zinc; and wood products.

Spokane County as the Center of the Region. While Spokane County shares in the agricultural production of the Inland Empire, its major role is as a service center for the region. Wholesale and retail trade, services and government are the most important economic sectors, accounting for two-thirds of all non-agricultural wage and salary jobs in both 1970 and 1979. Manufacturing was the fourth most important sector in both years, bringing the four-sector share of employment to over 80 percent in both years.

To ascertain the importance of Spokane County in providing services to the region in which it is located, the structure of the County economy was compared to the structure of the national economy. To the extent that an industry's share of local employment exceeded its share of national employment, Spokane County was considered to be an "exporter" of that industry's output; in other words, to provide that type of product or service to the region outside the County. For example, in Spokane County the trade sector was responsible for 28.2 percent of non-agricultural wage and salary employment in 1979, while in the United States as a whole trade employed 22.5 percent of such workers; thus, using the method known as location quotient analysis, it was estimated that about 20 percent of trade activity in Spokane County serves non-county residents (see Appendix D, page 241 for further discussion).

In addition to trade, the other sectors that were judged to provide output for non-Spokane County residents in 1979 were services, finance-insurance-real estate, construction and transportation-public utilities. It is interesting to note that neither of the two sectors traditionally assumed to be export industries - mining and manufacturing - plays this role in Spokane County.*

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*A third such sector, agriculture, was not included in this analysis of export activities because employment statistics for agriculture are not compiled with other employment data.

Recent Trends in County Employment. The Spokane County economy, as reflected in the number of jobs, grew at a healthy average rate of 4.0 percent per year during the 1970's, from 90,100 non-agricultural wage and salary jobs in 1970 to 128,100 such jobs in 1979. This rate of growth was equaled or exceeded by every economic sector except transportation-public utilities and government. The greatest growth *rates* occurred in mining-forestry (9.9 percent per year), contract construction (5.0 percent per year) and trade (4.9 percent per year); the greatest *numeric* growth was experienced in the trade sector (12,700 jobs over the nine-year period).

The most important influence on the county economy during the 1970's was EXPO '74. Preparation for and presentation of EXPO stimulated employment growth beginning in 1972, and was responsible for between 7,000 and 10,000 jobs during the fair's six-month peak operation period.

Employment in Spokane County declined between 1974 and 1975, with the end of the fair and the effects of the national recession, but has increased steadily since that time at rates comparable to those observed in the pre-EXPO period. Growth since 1974 has been concentrated in trade, with 7,500 new jobs since that year; services, with 4,500 new jobs; and manufacturing, with 4,000 new jobs.

Future Economic Conditions

Influences on Economic Growth. The future growth of the Spokane County economy will depend on a number of factors. One such factor is the status of natural resources which support the agricultural, mining and lumber industries of the region it serves; those industries must remain healthy to continue to generate demand for the trade, services and other "outputs" the county supplies to the rest of the region. Another factor is the availability of infrastructure, such as wastewater treatment systems, roads and electrical power. In particular, the availability of inexpensive and abundant electrical power, provided by Grand Coulee Dam and related projects, has brought large power users such as aluminum companies to the Pacific Northwest in the past. The notification that private contracts for large blocks of uninterruptible power will not be renewed after 1981 is likely to affect the further growth of that type of industry in the region (Walsh pers. comm.).

A third factor is changing technology. Improvements in industrial processes that make some operations more or less feasible, the substitution of capital (machines) for labor, and the development of new types of products and services are some of the changes that will affect the economy and, more particularly, the level of employment in Spokane County.

A fourth factor, and the last to be mentioned here, is the environment, both natural and social. Natural environmental factors that may draw employers and workers to the area are clean air, nearby rural areas and proximity to mountains and recreational opportunities. Social environmental factors that are likely to influence the location decisions of employers and employees are the availability and price of land for development, the availability and price of housing, the size of the labor force and the unemployment rate, and the perceived general quality of life in the Spokane area.

Projections of Employment Growth in Spokane County. A number of projections of future employment in Spokane County were prepared during the 1970's by national, regional and local agencies. These projections were based on a variety of approaches, all reflecting past growth patterns and assigning varying amounts of relative importance to those past patterns on the one hand and to expected changes in economic conditions - such as the factors described above - on the other.

The projections of county employment in the year 2000 range from 129,800 (Economics Research Associates 1976; low projection) to 206,500 (U. S. Department of Energy, Bonneville Power Administration 1979). These totals would reflect increases over the 1979 employment level (128,100 jobs) of 1.3 percent and 61.2 percent, respectively. In this light, the former projection, based on pre-EXPO 1974 growth trends, appears unrealistically low. The employment projections are summarized in Table 2-33 and discussed more fully in Appendix D.

Projections of Employment Growth in the Metropolitan Spokane Area. In addition to the projections of countywide employment, two projections of employment in the Spokane metropolitan area have been published. The metropolitan area is roughly similar to the CWMP study area, including the City of Spokane and the urbanized area extending eastward to include Liberty Lake and Newman Lake, northward to encompass the north Spokane suburban area, westward to include the West Plains and southward to include Glenwood-Moran Prairie.

The low projection for the metropolitan area (Economics Research Associates 1976, low projection) forecasts an increase from 106,970 jobs in 1975 to 121,190 jobs in the year 2000, an increase of 13.3 percent. The high projection (Spokane Regional Planning Conference 1979) anticipates an increase from 105,098 jobs in 1975 to 170,000 in the year 2000, an increase of 61.8 percent. These projections are summarized in Table 2-34.

Table 2-33

EMPLOYMENT PROJECTIONS FOR SPOKANE COUNTY

Source (Date)	Employment 1970	1975	1980	1990	2000	Increase 1980-2000	Av. Annual % Increase 1980-2000
OBERS (1972)	105,888	-	124,600	130,100	138,700	14,100	0.54
Water Resources Study (1976)							
Low Projection	104,700	-	111,000	121,800	132,900	21,900	0.90
High Projection	104,700	-	118,000	125,000	140,900	28,900	1.15
Economics Research Associates (1976)							
Low Projection	-	115,700	117,400	123,400	129,800	12,400	0.50
Medium Projection	-	115,700	122,700	140,300	158,000	35,300	1.27
High Projection	-	115,700	127,600	151,400	175,000	47,400	1.59
Bonneville Power Administration (1979)	-	117,100	144,100	178,700	206,500	62,445	1.82

Note: Projections which do not extend to the year 2000 or which do not cover the entire county are not included in this table.

Sources: U.S. Water Resources Council, 1972 OBERS Projections, Volume 5; U.S. Army Corps of Engineers, Seattle District and Kennedy-Tudor Consulting Engineers, Metropolitan Spokane Region Water Resources Study, Appendix F; Economics Research Associates, Employment, Population, Income and Other Projections for Spokane County 1975-2000 and Floyd E. Lauerson, A Summary of, and Excerpts from the Report: Employment, Population, Income and Other Projections for Spokane County, 1975-2000; U.S. Department of Energy, Bonneville Power Administration, Population, Employment and Households Projected to 2000, Washington.

Table 2-34

EMPLOYMENT PROJECTIONS FOR THE SPOKANE METROPOLITAN AREA

Source (Date)	Employment 1975	Employment 1980	Employment 1990	Employment 2000	Increase 1980-2000	Av. Annual % Increase 1980-2000
Economics Research Associates (1976)						
Low Projection	106,970	88,960	114,750	121,190	32,230	1.56
Medium Projection	106,970	113,700	131,200	148,220	34,520	1.33
High Projection	106,970	118,400	141,280	163,970	45,570	1.64
Spokane Regional Planning Conference (1979)[1]	105,098	122,500[2]	-	170,000	47,500	1.65

[1] Estimates for other years: 1970 = 98,920; 1978 = 117,000; 1982 = 128,000.
[2] Linear extrapolation from estimates for 1978 and 1982.

Sources: Economics Research Associates, *Employment, Population, Income and Other Projections for Spokane County 1975-2000* and Floyd E. Lauerson, *A Summary of, and Excerpts from the Report: Employment, Population, Income and Other Projections for Spokane County, 1975-2000*; Spokane Regional Planning Conference, Transportation Study Division, Technical Memorandum FL3 (March 21, 1979) and Technical Memorandum JB11 (September 6, 1980).

Employment in the Year 2002. The planning period for the CWMP study is 1982 through 2002. For that reason, it is desirable to extend the projections that have been prepared to 2002 or, for projections that extend through the year 2020, to interpolate an estimate for that year. These estimates are presented in Table 2-35.

Table 2-35

ESTIMATES OF EMPLOYMENT IN YEAR 2002

Projection	Projected Employment in 2000	Estimated Employment in 2002
Countywide projections		
OBERS	138,700	139,350
Water Resources Study		
Low	132,900	135,120
High	140,900	144,080
Economics Research Associates		
Low	129,800	131,070
Medium	158,000	161,600
High	175,000	179,710
Bonneville Power Administration	206,500	212,060
Metropolitan area projections		
Economics Research Associates		
Low	121,190	122,450
Medium	148,220	151,670
High	163,970	168,548
Spokane Regional Planning Conference	170,000	174,670

Note: All estimates for 2002 derived from linear interpolation or extrapolation.

Sources: Same as for Tables 2-33 and 2-34

Impacts on Housing Conditions

The impact of the proposed project on housing conditions in the CWMP study area will be its accommodation of dwelling units that could not have been built with onsite or more local wastewater collection and treatment systems. At the same time, growth in the study area will depend in part on the ability of local workers to find affordable housing. This section reviews existing housing conditions and derives a projection of the number of dwelling units in the area at the end of the planning period.

Existing Conditions. Data on existing housing conditions are available for the County of Spokane, the Spokane urbanized area and the City of Spokane for 1970 and for the County of Spokane only for 1974. Preliminary data from the 1980 U. S. Census are available only for the City of Spokane as of November 1980. Information presented here focuses on Spokane County; additional information for other areas is presented in Appendix D.

In 1970, Spokane County had 99,869 dwelling units, of which 99,429 were suitable for year-round occupancy and 93,681 were occupied. By 1974, the total number of units had increased to 112,100 and the number of occupied units to 103,800. In 1980, there were an estimated 132,137 dwelling units, of which about 123,900 were occupied. These figures are summarized in Table 2-36.

Table 2-36

HOUSING UNITS AND OCCUPANCY, SPOKANE COUNTY: 1970, 1974, 1980

				Increase, 1970-1980	
	1970	1974	1980	Number	Percent
Total dwelling units	99,869	112,100	132,137	32,268	32.3
Year-round dwelling units	99,429	111,800	n.a.	n.a.	n.a.
Occupied dwelling units	93,681	103,800	123,900	30,219	32.3
Percent of year-round units occupied	94.2	92.8	n.a.	n.a.	n.a.

n.a.: not available.

Sources: U. S. Census of Housing, General Housing Characteristics, Washington, 1970 (Table 8); U. S. Department of Commerce, Bureau of the Census, Current Housing Reports, Annual Housing Survey: 1974, Housing Characteristics for Selected Metropolitan Areas, Spokane, Washington SMSA (Table 1, page A-01); U. S. Department of Housing and Urban Development, Seattle Area Office, The Current Housing Market Situation, Spokane SMSA, March 1, 1980.

As the number of dwelling units in the county increased, the composition of the housing stock changed. As indicated in Table 2-37, the proportion of all units in detached single-family structures declined between 1970 and 1974 while all other structure types gained in importance. The greatest proportional increase was in attached single-family units.

Table 2-37

DISTRIBUTION OF HOUSING UNITS BY TYPE OF STRUCTURE, 1970 AND 1974
(Percent)

Type of Structure	1970	1974	Percent of Total Increase
Single-family, detached	77.0	73.3	43.5
Single-family, attached	0.6	3.0	22.6
2 to 4 families	7.5	7.8	9.7
5 or more families	12.5	12.9	16.1
Mobile home	2.4	3.0	8.1
TOTAL	100.0	100.0	100.0

Source: U. S. Department of Commerce, Bureau of the Census, Current Housing Reports, Annual Housing Survey: 1974, Housing Characteristics for Selected Standard Metropolitan Statistical Areas, Spokane, Washington SMSA (Table 1, page A-01).

Future Conditions. The number and types of dwelling units in Spokane County - and, more specifically, in the General Sewer Service Area - in the future will depend on a series of key factors. The number of people living in the area, the number of households and the incomes of those households in relation to housing prices will define the number of units demanded. The preferred living arrangements of the households, influenced by their incomes, will shape the composition of the housing stock. The costs of land, building materials, labor and financing will influence the ability of private developers to supply the housing demanded. The availability and acceptance of federal, state and local programs for housing provision will affect the ability of non-market suppliers to satisfy the housing needs of households who cannot afford to compete for market-rate housing.

The future number of housing units demanded in the General Sewer Service Area may be projected by making assumptions about population, household size and the number or proportion of vacant housing units. This projection is presented in Table 2-38. It assumes (1) that population in the area will increase from 120,065 in 1980 to 214,216 in 2002; (2) that the average number of people per household will decrease from 2.8 in 1970 to 2.7 in 2002; and (3) that approximately six percent of the housing stock will be vacant at any given time. This projection is discussed in more detail in Appendix D (page 241).

Table 2-38. Housing Units in the General Sewer Service Area, 1980 (estimate), 1992 and 2002 (projections)

	1980	1992	2002	Increase 1980-2002
Population	120,065[3]	172,907	214,216	94,151
Average Household Size	2.8	2.8	2.7	-
Number of Households[1]	42,880	61,752	79,339	36,459
Vacant Housing Units[2]	2,572	3,705	4,760	2,188
Total Housing Units	45,452	65,457	84,099	38,647

[1] Same as number of occupied dwelling units

[2] Six percent of total housing units

[3] 1980 preliminary census for Spokane County less the preliminary census for the City of Spokane and less estimated 1980 population of areas outside of GSSA

SOURCES: Jones & Stokes Associates, Inc. and Gruen Gruen + Associates.

This projection implicitly assumes that the other factors mentioned - such as household incomes relative to housing prices, developers' abilities to supply housing and the availability of public housing programs - will remain as they have been in recent years. If these factors change, they will affect the availability and affordability of housing in the Spokane area. To the extent that housing becomes more available or incomes rise relative to housing prices, Spokane may become a more attractive place to live and growth may increase above current projections. If, on the other hand, housing becomes less availabile - e.g., because of growth management programs or space limitations - or prices rise in relation to incomes, then growth in the area may be discouraged.

Impacts on Public Services and Public Finance

The impacts of the proposed project on public services and public finance in the CWMP study area are closely linked. The employment and population growth accommodated by the project will create demand for additional public services to be provided by the county, cities and special districts within the area. The provision of additional services will be possible if the agencies are financially able, which will be the case either if their revenues currently exceed their expenditures or if the new development (employment, population) generates revenues that equal or exceed the cost of the added services.

The service-providing agencies in the study area are the County of Spokane, the City of Spokane, the Town of Millwood, the City of Airway Heights, the Liberty Lake Sewer District and a number of school districts, fire protection districts and cemetery districts. These agencies differ markedly in the number of people they serve, the types of services they provide, their financial conditions and their expected fiscal abilities to handle future growth. Each is discussed in turn after a brief review of the structure of local government finance. Both of these subjects - the structure of local government finance and the financial conditions of the major service-providing entities - are presented in greater detail in Appendix D.

Structure of Local Government Finance. Public agencies incur two types of public service costs: capital costs and operating costs. Capital costs are expenditures for land, buildings and other major facilities such as roads, water and sewer lines and major pieces of equipment. Operating costs are expenditures for personnel, supplies, utilities, maintenance and the other day-to-day costs of service provision.

The revenues available to cover these costs come from a variety of sources. Capital costs are usually covered by (1) the sale of bonds, (2) grants or loans from the federal or state government or (3) accumulated reserves. When bonds are issued or loans from other agencies are accepted, however, the money needed for repayment of those obligations becomes an ongoing cost just like other operating costs. Operating costs are covered with revenues from four major sources: (1) property and other taxes, (2) service/user charges, (3) shared revenues from state and federal governments and (4) development fees.

The issuance of bonds and the collection of property taxes is closely regulated. Property taxes collected by all agencies may not exceed a total of one percent of the assessed value of a property (assessed value equals full market value), and an agency's total property tax collection may not exceed 106 percent of the greatest amount collected in any of the three previous years. There are three exceptions to these limits: (1) new development may be added into the collection base; (2) voters may approve bond issues or one-time levies that will be repaid out of additional property taxes and (3) voters may suspend the 106 percent limit for one year. This last action may be taken one time only.

Three types of bonds may be issued to cover capital expenses, and the dollar amount of each type is also closely regulated. General obligation bonds, repaid out of property taxes, are limited to 0.75 percent of assessed valuation without voter approval and 7.5 percent of assessed valuation with voter approval. Revenue bonds, repaid out of user fees, are limited to about 70 percent of debt coverage available from those fees. Local improvement district (LID) and utility local improvement district (ULID) bonds, repaid out of assessments on benefited properties, are also limited by the assessed values of those properties. These regulations are described more fully in Appendix D.

Fiscal Conditions of Service Providers in the CWMP Study Area. Interviews were conducted with officials of three general purpose governments and the sewer district to gain information about current financial conditions and likely future conditions. Information for the fourth general purpose government, the City of Airway Heights, is based on a review of the city budget.

County of Spokane. The County of Spokane is a general purpose government which provides some services to all county residents and some only to residents of the unincorporated area. The first group of services includes social services, property assessment, public health, cooperative extension, interstate fair, county jail, various courts and other justice services, and elections. The second group includes general government, sheriff and some other (primarily road-related) services.

The county has historically followed a conservative path of financial management, preferring to rely on local, rather than federal sources of funds, severely limiting expenditures and carefully managing county investments. As of December 1979, 15.5 percent of the county's allowed indebtedness for general obligation bonds was outstanding; this percentage decreased in 1980, when assessed valuation rose. The county budget director foresees no fiscal problems resulting from future population growth (Farnell pers. comm.).

City of Spokane. The City of Spokane provides a complete range of services to city residents: general government, fire and police protection, municipal courts, libraries, parks and recreation, street and traffic engineering, water, wastewater treatment and refuse collection. (The city also has a bus system, but operation of that system is expected to be transferred to a transit district early in 1981.)

The provision of public services to a growing population has not recently been an issue for the city, as its area is almost fully developed and its population has remained stable for a decade. Increases in property tax and sales tax revenues have generally covered operating expenses while grants from state and federal governments have covered capital expenses. According to the finance director, however, those conditions are about to change; both increased user charges and a series of general obligation and revenue bonds will be needed soon to cover some rising costs and capital improvements. (Only 11 percent of general obligation bonding capacity is currently committed.) If growth does occur - and the primary opportunity will be in annexation of adjacent unincorporated areas - significant capital expenditures will be required to allow any new development, and there will likely be a delay between those expenditures and the collection of any public revenues forthcoming from that development (Cole pers. comm.).

Town of Millwood. The Town of Millwood provides general government, fire protection, library, parks and some wastewater treatment service to its residents. The town has no outstanding indebtedness. The mayor anticipates little if any growth in the future, even if the proposed project is implemented, as its land area is fully developed and it has no annexation plans (Clearwaters pers. comm.).

City of Airway Heights. The City of Airway Heights provides general government, police and fire protection, library, parks and water. Based on budget indicators - including a cash reserve equal to nearly eight percent of the total budget and a property tax levy smaller than the statutory limit - the city appears to be in a sound fiscal position and able to accommodate growth; in addition, it already provides the range of services usually provided by larger communities. Nevertheless, the Spokane County Boundary Commission recently denied a request to annex an adjacent area that would have doubled the city's size, citing in part a concern for the fiscal ability to handle that much growth.

Liberty Lake Sewer District. The Liberty Lake Sewer District is the only special purpose sewer district in the study area, providing wastewater collection and treatment service to about 760 customers in the area around Liberty Lake. The district is also a water district, with authority to enter into binding arbitration to purchase water systems in its area.

The district's finances are somewhat different from those of the general purpose governments described above. Operating revenues are derived from connection charges to new customers and monthly user fees to customers already connected to the system. The district also collects a property tax levy to repay outstanding general obligation bonds. To finance current (November 1980) construction of a new wastewater treatment plant designed to handle one million gallons per day (1 mgd), the district has obtained grants from federal and state agencies and issued a package of general obligation bonds, revenue bonds and ULID bonds (the latter on behalf of private developers). The district has planned carefully for fiscal solvency, with adopted policies and resolutions which obligate developers of projects other than one single-family home to make financial contributions for plant capacity, interceptors and future planning (Kaun pers. comm.).

Summary. The five major service-providing agencies in the CWMP study area differ widely in their responsibilities for public service and their approaches to public finance. The County of Spokane has relied primarily on local funds for all expenditures, occasionally issuing bonds for capital improvements; the City of Spokane has relied extensively on federal and state funds for capital expenditures; the Town of Millwood pays cash for all its expenses. The county anticipates little trouble in maintaining its financial condition while accommodating population growth; the City of Spokane recognizes that user charges must be raised and some bond issues must be approved by the voters if it is to maintain fiscal solvency, and that any growth will require extensive capital expenditures before the city realizes any revenue gain; the Town of Millwood expects no growth at all and therefore no fiscal change. It thus appears that the impacts of the proposed project on public services and public finance will be felt primarily in the City of Spokane and particularly, depending on financing mechanisms, in areas annexed to the city as a result of the project. The degree to which cost and revenue changes will be different with and without the project, however, cannot be estimated at this time.

Table 2-39. Impacts Common to the Project Action Alternatives (A through F)

Area of Impact	Description of Impact	Possible Mitigation Measures
Surface water quality	Would eventually eliminate Liberty Lake waste discharge to Spokane River.	None needed.
Spokane River uses	Would eventually eliminate public health risks to water contact recreationists and downstream water supplies created by Liberty Lake wastewater discharge.	None needed.
Spokane River fishery	Trace heavy metal and toxin increases may affect egg and fry stages of fish downstream from wastewater outfalls.	Maximize effluent dilution by constructing outfall diffusers.
		Enforce pretreatment requirements for hazardous waste streams.
Groundwater quality	Eventual elimination of interim and on-site waste disposal systems serving about 87,000 residents now overlying the aquifer.	None needed.
	Possible groundwater contamination from increased sludge disposal at the City's northwest landfill.	Relocate City sludge disposal to a site off of the aquifer. Monitor sludge disposal area leachate to detect groundwater contamination.
	Would eventually eliminate Liberty Lake wastewater discharge from aquifer-river interchange area, reducing chance of aquifer contamination.	None needed.
Land use impacts	Odor and aesthetic impacts in residential area surrounding Indian Trail storage basin.	Construct berm or other visual screen around storage basin. Include odor control facilities at basin (aerators, chlorination equipment). Use basin for wet weather storage only.
Costs	Wastewater collection system financed by local improvement district formation: high density area - $3,233/residence medium density area - $4,815/residence low density area - $6,665/residence	None
	Hook-up from house to local collection system (cost variable depending on house and lot conditions).	None
Economic influences	Could stimulate housing construction in areas where on-site wastewater systems were not allowed.	None

Table 2-39 (cont'd.)

Area of Impact	Description of Impact	Possible Mitigation Measures
	Will require added government expenditures for public services, and subsequent expansion of government revenue sources.	None
Growth implications	Provides wastewater services for 87,000 existing and 89,000 new residents by 2002.	None
	Approximately 12,100 new residential acres added to the Spokane area by 2002.	None
	CWMP General Sewer Service Area (GSSA) population projection (excluding City) exceeds 208 projections by 13,078 in the year 2002.	None
	EPA-state approved population total for Spokane County is 19,800 less than CWMP population projection for the GSSA and the City only.	Limit federal grant to population level approved by state and EPA.
	CWMP Priority Sewer Service Area (PSSA) designation includes areas mapped as low density land use in the County Comprehensive Plan.	Omit proposed low density land use areas from the CWMP PSSA. Amend County Comprehensive Plan land use designations to higher densities within PSSA.
	Local increases in carbon monoxide levels along major transportation corridors in Spokane Valley and North Spokane.	Adopt and implement transportation control strategies contained in the State Implementation Plan for the Spokane area.
	Increased urban runoff to the Spokane River and Spokane Valley Aquifer from 12,100 new acres of residential development by 2002.	Implement runoff control strategies identified in the Spokane Aquifer 208 plan.
	Residential and industrial development of prime agricultural land will occur on Five Mile Prairie, in the Spokane Airport area, and in the northeast section of Spokane Valley.	Preferential property tax assessments of prime agricultural land. Transfer of development rights. Stricter state control of development on prime agricultural land. Revise land use designations on County Comprehensive Plan map.
	Increasing demand for most public services will require added capital investment or a decrease in level of service will occur.	None

Table 2-40. No-Action Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	None	
Surface water quality	Increase in algal growth immediately below Liberty Lake and Spokane treatment plant discharges.	Increase treatment for phosphorus removal at Spokane plant. Initiate phosphorus removal at Liberty Lake plant.
Spokane River uses	Increasing public health risks to water-contact recreationists below Liberty Lake and Spokane treatment plant discharges.	Increase efficiency of wastewater disinfection. Provide emergency storage at treatment plants. Discourage water-contact recreation below outfalls.
	Potential for contamination of water supply wells adjacent to the river below Liberty Lake discharge.	Increase wastewater disinfection. Provide emergency storage at Liberty Lake plant.
Spokane River fishery	Trace heavy metal and toxin increases may affect egg and fry stages of fish downstream from Liberty Lake and Spokane treatment plant outfalls.	Maximize effluent dilution by constructing outfall diffusers. Enforce pretreatment requirements for hazardous waste streams.
Groundwater quality	Continued groundwater contamination (nitrate and other hazardous wastes) from use of interim and on-site waste disposal systems over the Spokane aquifer.	None
Land use impacts	Odor and aesthetic complaints about existing interim treatment systems would continue.	None
Costs	Continuation of existing wastewater service fee structure (varies within GSSA).	None
Energy and chemicals	Continuation of existing low consumption pattern with onsite facilities.	None

Table 2-41. Alternative A Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 4 acres of open space to storage lagoon.	None
Surface water quality	Increase in algal growth immediately below Spokane treatment plant discharge.	Increase treatment for phosphorus removal at Spokane plant.
	Possible increase in algal growth in Long Lake due to increased phosphorus loading.	Increase treatment for phosphorus removal at Spokane plant. Initiate phosphorus removal at Liberty Lake plant.
	Possible dissolved oxygen reduction in Long Lake due to algal decomposition.	None
Spokane River uses	Increasing public health risks to water contact recreationists below Spokane treatment plant discharge (Riverside State Park, Long Lake).	Construct outfall diffuser. Increase efficiency of disinfection. Provide emergency storage at the Spokane treatment plant. Discourage water contact recreation below outfall.
	Possible increases in algal growth could degrade recreational and commercial value of Long Lake and surrounding property.	Increase treatment for phosphorus removal at Spokane plant. Initiate phosphorus removal at Liberty Lake plant.
Spokane River fishery	Dissolved oxygen decreases in deeper waters behind Nine Mile and Long Lake Dams may adversely affect egg and fry stages of fish.	Maximize effluent dilution by constructing outfall diffuser at Spokane plant.
Groundwater quality	See common impacts in Table 2-39.	
Land use impacts	Odor and visual impacts in residential area surrounding Spokane Valley wastewater storage basin.	Construct berm or other visual screen around storage basin. Include odor control facilities at basin (aerators, chlorination equipment). Use basin for wet weather storage only.
Costs	Present worth capital cost of $57,525,000.	None
	Monthly user fee of $8.56 in all areas.	None
Energy and chemicals	Electrical energy consumption of 14,541,719 Kwh per year by 1992.	Purchase energy-efficient equipment. Reuse waste heat and methane. Pump from storage basins during low demand hours.
	Chemical consumption of 876 tons chlorine and 14.4 tons ploymer per year by 1992.	Closely regulate chemical dosing. Removal phosphorus seasonally only.

Table 2-42. Alternative B Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 29 acres of open space to treatment facilities and 4 acres to storage basin.	None
Surface water quality	Increase in algal growth immediately below Spokane and Felts Field treatment plant discharges.	Increase treatment for phosphorus removal at Spokane and Felts Field plants.
Spokane River uses	Increasing public health risk to water-contact recreationists below Felts Field treatment plant discharge (Boulder Beach, Upriver Park) and Spokane treatment plant discharge (Riverside State Park, Long Lake).	Increase wastewater disinfection. Discourage water-contact recreation below outfalls. Provide emergency storage at treatment plants. Construct outfall diffusers.
	Psychological detraction to river uses within the City of Spokane due to Felts Field discharge.	None
Spokane River fishery	See common impact in Table 2-39.	
Groundwater quality	Felts Field discharge to river could contaminate water supplies downgradient from Upriver Dam recharge area.	Further investigate aquifer river interchange in Upriver Dam area. Monitor water supply wells near river downstream from Felts Field. Locate alternative water source.
Land use impacts	Odor, noise, and visual impacts in residential area surrounding Felts Field treatment plant.	Construct berm or other visual screen around treatment plant. Include odor control facilities at treatment plant. Minimize truck traffic to and from plant.
Costs	Present worth capital cost of $83,043,000.	None
	Monthly user cost of $10.70 in Spokane Valley and $9.08 in other areas.	None
Energy and chemicals	Electrical energy consumption of 15,169,758 Kwh per year by 1992.	Purchase energy-efficient equipment. Reuse waste heat and methane. Pump from storage basins during low demand hours.
	Chemical consumption of 857 tons chlorine and 14.3 tons polymer per year by 1992.	Closely regulate chemical dosing. Remove phosphorus on a seasonal basis.

Table 2-43. Alternative C Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 63 acres of open space to treatment facilities and 4 acres to storage basin.	None
Surface water quality	Increase in algal growth immediately below Spokane treatment plant discharge.	Increase treatment for phosphorus removal at Spokane plant.
	Possible increase in algal growth in Long Lake due to phosphorus loading.	Increase treatment for phosphorus removal at Spokane plant. Initiate phosphorus removal at Liberty Lake plant.
	Possible dissolved oxygen reduction in Long Lake due to algal decomposition.	None
Spokane River uses	Similar to Alternative A but slightly less severe.	
Spokane River fishery	Similar to Alternative A but slightly less severe.	
Groundwater quality	Probable groundwater degradation from land disposal of wastewater on northern fringe of Spokane aquifer.	Monitor effluent prior to land application. Monitor groundwater up and downgradient from disposal area. Inventory commercial and industrial waste contributors. Enforce pretreatment requirements for hazardous waste streams.
Land use impacts	Odor and visual impact in residential area surrounding Spokane Valley storage basin; visual impact from treatment plant in scenic Rutter Parkway area.	Construct berm or other visual screen around storage basin and treatment plant. Include odor control facilities at storage basin (aerators, chlorination equipment).
Costs	Present worth capital cost of $63,525,000.	None
	Monthly user fee of $10.75 in North Spokane and $7.48 in other areas.	None
Energy and chemicals	Electrical energy consumption of 13,322, 941 Kwh per year by 1992.	See mitigation for Alternative A.
	Chemical consumption of 803 tons chlorine and 13.7 tons polymer per year by 1992.	See mitigation for Alternative A.

Table 2-44. Alternative D Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 92 acres of open space to treatment facilities and 4 acres to storage basin.	None.
Surface water quality	Increase in algal growth immediately below Spokane and Felts Field treatment plant discharges.	Increase treatment for phosphorus removal at Spokane and Felts Field plants.
Spokane River uses	Similar to Alternative B impacts but less severe to uses below the Spokane treatment plant.	
Spokane River fishery	See common impact in Table 2-39.	
Groundwater quality	Same impacts as described for Alternatives B and C.	
Land use impacts	Odor, noise and visual impacts in residential area surrounding Felts Field plant, visual impact from treatment plant in scenic Rutter Parkway area.	Construct berm or other visual screen around treatment plants. Include odor control facilities at treatment plant. Minimize truck traffic to and from Felts Field plant.
Costs	Present worth capital cost of $92,609,000.	None
	Monthly user fee of $10.70 in Spokane Valley and $10.75 in North Spokane.	None
Energy and chemicals	Electrical energy consumption of 12,556,690 Kwh per year by 1992.	See mitigation for Alternative A.
	Chemical consumption of 821 tons chlorine and 13.7 tons polymer per year by 1992.	See mitigation for Alternative A.

Table 2-45. Alternative E Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 300 acres of open space to treatment facilities and 4 acres to storage basin.	None
Surface water quality	Increase in algal growth immediately below Spokane treatment plant discharge.	Increase treatment for phosphorus removal at Spokane plant.
Spokane River uses	Minor increase in public health risks to water contact recreationists below the Spokane treatment plant (Riverside State Park, Long Lake).	Increase efficiency of disinfection. Construct outfall diffuser. Provide emergency storage at Spokane treatment plant.
Spokane River fishery	See common impact in Table 2-39.	
Groundwater quality	Probable groundwater degradation from land disposal of wastewater on northern fringe of Spokane aquifer.	Monitor effluent prior to land application. Monitor groundwater up- and downgradient from disposal area. Inventory commercial and industrial waste contributors. Enforce pretreatment requirements for hazardous waste stream.
Land use impacts.	Visual impact from treatment in scenic Rutter Parkway area.	Construct berm or visual screen around treatment plant.
Costs	Present worth capital cost of $86,664,000.	None
	Monthly user fee of $9.54 in North Spokane and Spokane Valley.	None
Energy and chemicals	Electrical energy consumption of 25,109,380 Kwh per year by 1992.	See mitigation for Alternative A.
	Chemical consumption of 712 tons chlorine and 12 tons polymer per year by 1992.	Closely regulate chemical dosing.

Table 2-46. Alternative F Impacts and Mitigations

Area of Impact	Description of Impact	Possible Mitigation Measures
Construction losses	Conversion of 735 acres of open space to treatment facilities and 4 acres to storage basin.	None
Surface water quality	Removes most wastewater influence from Spokane River, reducing algal standing crop in Long Lake and other downstream areas.	None needed.
Spokane River uses	Removes public health threat and aesthetic degradation affecting all beneficial uses below the Spokane treatment plant.	None needed.
Spokane River fishery	Reduction in BOD, metals, and toxins loading from Spokane plant wastewater beneficial to downstream fishery.	None needed.
Groundwater quality	Would eliminate most wastewater disposal over Spokane aquifer.	None needed.
	Probable contamination of groundwater below disposal site (not currently used as major water source).	Monitor groundwater and Long Lake in vicinity of disposal area.
Natural land resources	Conversion of 8 acres of prime agricultural land at the Confluence treatment plant site.	None
Land use impacts	Odor and visual impacts in residential area surrounding Spokane Valley storage basin; visual impact from treatment facility at Confluence site and disposal facility at Downriver site.	Construct berm or visual screen around storage basin, treatment plant, and disposal area. Include odor control facilities at storage basin (aerators, chlorination equipment).
Costs	Present worth capital cost of $96,214,000.	None
	Monthly user fee of $8.68 in Spokane Valley and $10.62 in North Spokane.	None
Energy and chemicals	Electrical energy consumption of 50,593,899 Kwh per year by 1992.	See mitigation for Alternative A.
	Chemical consumption of 803 tons chlorine and 13.7 tons polymer per year by 1992.	See mitigation for Alternative A.

Chapter 3

Coordination

Chapter 3

COORDINATION

Introduction

Section 6.203 of the EPA procedures for implementation of the National Environmental Policy Act (Federal Register, Vol. 44, No. 216, November 6, 1979) requires that all EISs discuss the extent and results of coordination activities conducted prior to publication of EISs. This chapter describes the involvement of government agencies, special interest groups, and the public in general in determining the scope and content of this EIS. It also describes, how, when, and where coordination efforts will continue.

Coordination Efforts to Date

Coordination efforts on the Spokane County CWMP EIS began in February 1980 with publication in the Federal Register of a Notice of Intent to prepare the EIS. This was followed by an EIS scoping meeting, held in Spokane on February 20, 1980. At that meeting 16 agency personnel and interested local residents discussed the CWMP project and the environmental issues that it was likely to raise. EPA sought guidance for the subsequent environmental investigations that it would undertake.

The scoping meeting conversations centered around surface and groundwater quality, land use planning, and recreational use of the Spokane River. Some of the major concerns expressed at the meeting were as follows:

- Influence of upriver waste discharges on City wells, the Spokane River fishery, and water contact recreation.
- Influence of Idaho waste discharges on the Spokane River and Spokane Valley Aquifer.
- Influence of continued septic tank proliferation on aquifer quality.
- Methodology to be used by the CWMP in determining location and rate of population increases in the County area.

Since the scoping meeting EPA has contacted a wide variety of individuals and agencies to collect background data and define project-related environmental issues. These contacts have been made in person, by phone, and by letter. In addition, EPA has participated in several of the facilities plan public participation activities. This includes attendance at several CWMP technical evaluation team and review committee meetings in Spokane.

On April 10, 1980, EPA conducted its first EIS public workshop in Spokane. This meeting sought to inform citizens of the project alternatives being pursued by the facilities planners. It also sought further input on the environmental issues to be addressed by the EIS. The small group that attended the meeting again focused its discussions on Spokane River water quality. Other topics that were discussed included:

- The relationship of the City's combined sewer overflow abatement project with CWMP alternatives.
- Wastewater treatment requirements at the proposed Liberty Lake treatment plant.
- Methods of financing the CWMP.
- The number and type of CWMP alternatives that will be analyzed in the EIS.
- The need to consider formation of septic tank maintenance districts in highly urbanized, unsewered County areas.

After 7 months of additional work on the CWMP facilities plan and completion of a preliminary version of this Draft EIS, a second EPA-Spokane County public workshop was held. The meeting was conducted in Spokane on November 18, 1980. At that meeting, the CWMP engineers outlined the details of their preferred project alternative. They identified Alternative A as the most cost-effective, implementable method of providing planning area residents with centralized wastewater service. EPA presented the preliminary findings of its environmental impact analysis.

The large audience directed a variety of questions to both EPA and the facilities planners. The principal topics of discussion were:

- What would the recommended project cost each individual in the proposed service area?
- How would the proposed project be financed?
- Alternative wastewater treatment technologies, such as composting toilets, should be considered.
- The "no-action" discussion should include the chemical and energy uses of interim wastewater treatment systems and the financial ramifications of contaminating the area's drinking water supply.

- The adverse effects of increased urban runoff should be described.

- Will persons in unsewered low density areas have the option of staying outside local improvement districts when they are formed to pay for collection systems?

Suggestions and Objections Received Through Coordination

Through its coordination efforts, EPA has received several suggestions and objections that have influenced the content of this Draft EIS. The most important of these are summarized below.

Issues Coverage

The U. S. Fish and Wildlife Service (USFWS) area office in Olympia, Washington was contacted to determine if any wildlife or plant species on the federal threatened or endangered lists were known to occur in the CWMP facilities planning area. The USFWS replied that the bald eagle is the only federally listed species known within the area. The USFWS also indicated that three birds (Swainson's hawk, long-billed curlew, and snowy plover) and two plants (*Balsamorhiza rosea* and *Silene spaldingii*) are candidates for endangered or threatened status. As a result of this exchange, the biological impacts research for the EIS was broadened to investigate these species.

The Washington Department of Game was also contacted about candidate endangered and threatened plant and animal species in the Spokane area. Staff of the department's non-game program responded with information from the Washington Natural Heritage Data System. This included information on the known locations of special plants, animals and plant communities within the CWMP study area. The locational information was used in preparing the wildlife and vegetation impacts sections of this EIS.

Section 106 of the National Historic Preservation Act requires the head of any federal agency with jurisdiction over a proposed federal or federally-assisted project to consider the impact of the project on sites, districts or structures included on or eligible for inclusion on the National Register of Historic Places prior to taking action on the project. The federal agency must also provide the Advisory Council on Historic Preservation the opportunity to review the cultural and historic implications of the proposed project prior to action.

Regulations implementing Section 106 identify the procedure for evaluating potential impacts on properties on or eligible for the National Register. This includes: 1) identifying properties within the project's area of impact that are on or eligible for inclusion on the National Register of Historic Places (this includes consulting the National Register and the State Historic Preservation Officer [SHPO]); 2) determining whether properties on or eligible for the National Register might be affected by the project; 3) determining if the affect is adverse; 4) notifying the Advisory Council and the SHPO of the findings of the impact analysis; and 5) proceeding with the consultation process if an adverse effect is anticipated.

In compliance with these regulations, EPA requested that Spokane County submit preliminary planning descriptions and planning area maps to the Washington SHPO. The SHPO has reviewed the proposed project's area of impact and has recommended that several areas with a high potential for the occurrence of archeological resources be subjected to intensive literature and records searches and field surveys (see letter in Appendix E). Once specific project facilities locations have been determined and a definitive facilities plan has been selected, potentially affected areas will be subjected to the appropriate level of study and the results will be submitted to the Washington SHPO and the Advisory Council for their further review. If areas on or eligible for inclusion on the National Register possibly would be affected, the remaining steps required by Section 106 will be completed. This will occur prior to final action on the project by the EPA Administrator.

Upcoming Coordination Efforts

This Draft EIS has been forwarded to numerous federal, state and local agencies; special interest groups; and private citizens to act as both an informational document and as an avenue to comment on the proposed wastewater project. The distribution list is included as Appendix F. The document has been forwarded to public libraries in the Spokane area so that other concerned residents can review the potential impacts of the project.

Individuals or groups that wish to comment on the EIS may forward written comments to:

Ms. Kathryn Davidson, M/S 443
U. S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, Washington 98101

A public hearing to solicit oral comments on the Draft EIS or the wastewater facilities plan will be held by EPA at:

Spokane County Health District Auditorium
West 1101 College
Spokane, Washington
7:30 p.m., March 25, 1981

All oral and written comments received on the Draft EIS will be recorded and responded to in a Final EIS, which will be made available to interested individuals, groups and agencies approximately 3 months after the public hearing.

LIST OF REPORT PREPARERS

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Area of EIS Responsibility. Preparation of reference listing.

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Area of EIS Responsibility. Facilities plan review, project costs, project description.

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Area of EIS Responsibility. Land use compatibility.

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Area of EIS Responsibility. Report graphics.

ACRONYMS AND ABBREVIATIONS

ADWF	- average dry weather flow
AWT	- advanced waste treatment
BEA	- U. S. Department of Commerce, Bureau of Economic Analysis
BOD	- biochemical oxygen demand
BOD_5	- 5-day biochemical oxygen demand
BTU	- British thermal unit
CAA	- Clean Air Act
$CaCO_3$	- calcium carbonate
CFR	- codes of federal regulations
cfs	- cubic feet per second
Cl	- chloride
CO	- carbon monoxide
CSO	- combined sewer overflow
CWMP	- Comprehensive Wastewater Management Plan
DOE	- Washington Department of Ecology
DSHS	- Washington Department of Social and Health Services
du	- dwelling unit
EIS	- Environmental Impact Statement
EPA	- U. S. Environmental Protection Agency
FIA	- U. S. Department of Housing and Urban Development, Federal Insurance Administration
GSP	- general sewerage plan
GSSA	- general sewer service area (projected 20-year service area)
Kwh	- kilowatt hours
lbs/day	- pounds per day
LID	- local improvement district
MCL	- maximum contaminant level (contained in NIPDWR)
MGD	- million gallons per day
mg/l	- milligrams per liter
MPN/100 ml	- most probable number per 100 milliliters
N	- nitrogen
NAAQS	- national ambient air quality standards (contained in CWA)

NEPA - National Environmental Policy Act

NH_3 - ammonia (un-ionized)

NH_4 - ammonium (ionized)

NIPDWR - national interim primary drinking water regulations

NO_3-N - nitrate measured as nitrogen

NPDES - national pollutant discharge elimination system

O_2 - oxygen

OBERS - U. S. Department of Agriculture, Office of Business, Economics and the Economic Research Service

OFM - Washington Office of Financial Management

P - phosphorus

pers. comm. - personal communication

PL - public law

PO_4 - phosphate

PSSA - priority sewer service area (projected 10-year service area)

PWWF - peak wet weather flow

Q_{7-10} - lowest average 7-day flow recorded in a 10-year time span

RCRA - Resource Conservation and Recovery Act

RCW - Revised Code of Washington

RM - river mile

SCS - U. S. Department of Agriculture, Soil Conservation Service

SDWA - Safe Drinking Water Act

SHPO - State Historic Preservation Office

SIP - State Implementation Plan (required by CAA)

SRPC - Spokane Regional Planning Conference

STP - sewage treatment plant

TDS - total dissolved solids

ud/wk - user-days per week

ULID - utility local improvement district

USC - United States Code

USGS - U. S. Geological Survey

WAC - Washington Administrative Code

WMA - wastewater management area (facilities plan study area)

WSWQS - Washington State Water Quality Standards

WWP - Washington Water Power Company

μg/gm - microgram per gram

μmho/cm - micro mho per cubic centimeter

96 LC_{50} - 96-hour, 50 percent lethal concentration (concentration that will kill 50 percent of test organisms in a 96-hour period)

201 - Section 201 of the Clean Water Act (wastewater facilities planning)

208 - Section 208 of the Clean Water Act (areawide water quality management planning)

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Appendix A

AIR QUALITY BACKGROUND DATA

Air Quality Legislation

Federal and state activities relating to air quality have been authorized by several pieces of legislation, the most important of which are the 1970 and 1977 amendments to the Federal Clean Air Act (CAA).

The 1970 amendments transferred the air pollution control activities of the federal government to the Environmental Protection Agency (EPA). The CAA authorized EPA to establish national air quality guidelines, which involve primary and secondary standards. The primary standards identify ambient air quality levels necessary to protect public health with an adequate margin of safety. Secondary standards, which are often more stringent, relate to air quality levels necessary to protect public welfare, such as the prevention of air pollution damage to crops, natural vegetation, materials, and structures. Other EPA regulatory functions include the following:

1. Establishment of emission standards for stationary and mobile sources of air pollution;
2. Involvement in research programs;
3. Provision of financial assistance to pollution control agencies.

In order to obtain National Ambient Air Quality Standards (NAAQS), the Spokane area must reduce concentrations of carbon monoxide (CO) and total suspended particulates (TSP). The State of Washington and the EPA both have established ambient air quality standards that should be met before 1983. These standards are shown in Table A-1.

To help achieve and maintain these air quality standards, all states were required to develop and adopt State Implementation Plans (SIPs). The original deadline was July 1979 with provisions for an extension period up to two years for selected standards in specific regions.

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Table A-1. Ambient Air Quality Standards

POLLUTANT	NATIONAL Primary	NATIONAL Secondary	WASHINGTON STATE
TOTAL SUSPENDED PARTICULATES			
Annual Geometric Mean	75 $\mu g/m^3$	60 $\mu g/m^3$	60 $\mu g/m^3$
24-Hour Average	260 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
CARBON MONOXIDE			
8-Hour Average	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)
1-Hour Average	40 mg/m^3 (35 ppm)*	40 mg/m^3 (35 ppm)*	40 mg/m^3 (35 ppm)*

NOTE: mg/m^3 = milligrams per cubic meter
$\mu g/m^3$ = micrograms per cubic meter

Annual standards never to be exceeded, short-term standards not to be exceeded more than once per year unless noted.

*EPA has proposed revising the 1-Hour CO standards to 28.6 mg/m^3 (25 ppm); no final action has yet been taken.

SOURCE: Washington Department of Ecology 1979.

In 1977 CAA amendments recognized the fact that most major urban regions failed to attain the primary air quality standards. These new amendments required the states and EPA to identify: (1) all the areas which met all federal standards, (2) areas which exceed any federal standard, and (3) areas where sufficient data are lacking. Spokane County has been designated a "non-attainment" area with respect to CO and TSP.

Pollutant Sources

The monitoring system is designed to keep an accurate record of CO and TSP levels. Excess concentrations of these compounds are detrimental to human welfare, and it is important to realize the health implications, as well as the local pollution sources.

Total Suspended Particulates

Total suspended particulates are long-term airborne particles with a diameter less than 100 microns. This includes dusts and smokes of various origins. Long-term exposure to high particulate levels has been shown to increase respiratory illness, especially chronic problems. The main contributors to the study region's particulate concentrations are listed in Table A-2.

Carbon Monoxide

Carbon Monoxide is a colorless, tasteless and odorless gas that is a product of incomplete combustion of fuels. More than 90 percent of measured CO is generated by gasoline powered vehicles, with the remainder from residential, commercial and industrial heating (Spokane County Air Pollution Control Authority 1979). The harmful effects of CO are attributable to its ability to decrease the oxygen levels in blood, and consequently, the brain. The sources of carbon monoxide are shown in Table A-3.

Monitoring Data

Air pollution monitoring in Spokane is conducted by the Spokane County Air Pollution Control Authority (SCAPCA). Monitoring stations are regulated by DOE and have been compiling data since 1971.

Table A-2. Major Sources of TSPs in Metropolitan Spokane

Source	Amount (tons/yr)	Percent of Total Emissions
Point Sources	1,749	13.9
Space Heating	1,130	9.0
Unpaved Roads	3,581	28.4
Fuel Combustion	914	7.2
Rural Dust (Agricultural Operations)	1,648	13.1
Paved Roads	3,482	27.6

SOURCE: Spokane County Air Pollution Control Authority 1979.

Table A-3. CO Emissions by Area in Metropolitan Spokane

Location	Emissions	
Downtown Area	18,500 kg/day	(20 tons/day)
Remainder of Non-Attainment Area[1]	42,400 kg/day	(47 tons/day)
TOTAL	60,000 kg/day	(67 tons/day)

---

[1] Non-attainment area is shown in Figure A-1

SOURCE: Spokane Regional Planning Conference 1978

For particulates, the initial monitoring program began with two stations; on Boone Street and at City Hall (Washington Department of Ecology 1977). By 1974 the particulate program had expanded to six stations, and there are presently ten monitoring locations.

Based on annual high TSP concentrations, the station located at the Crown Zellerbach Warehouse on Ferry Avenue has consistently had among the highest measured TSP levels. The locations of all the monitoring sites are shown in Figure A-1.

The carbon monoxide monitoring system has also undergone changes since its inception. The original number of stations was not available, but by 1976 there were 13 stations (Washington Department of Ecology 1977). Contrary to the particulate program, however, some of the stations were moved or discontinued, to better reflect the overall CO problem. The 1979 DOE air quality summary lists list 10 CO monitoring stations (see Figure A-1) (Washington Department of Ecology 1979).

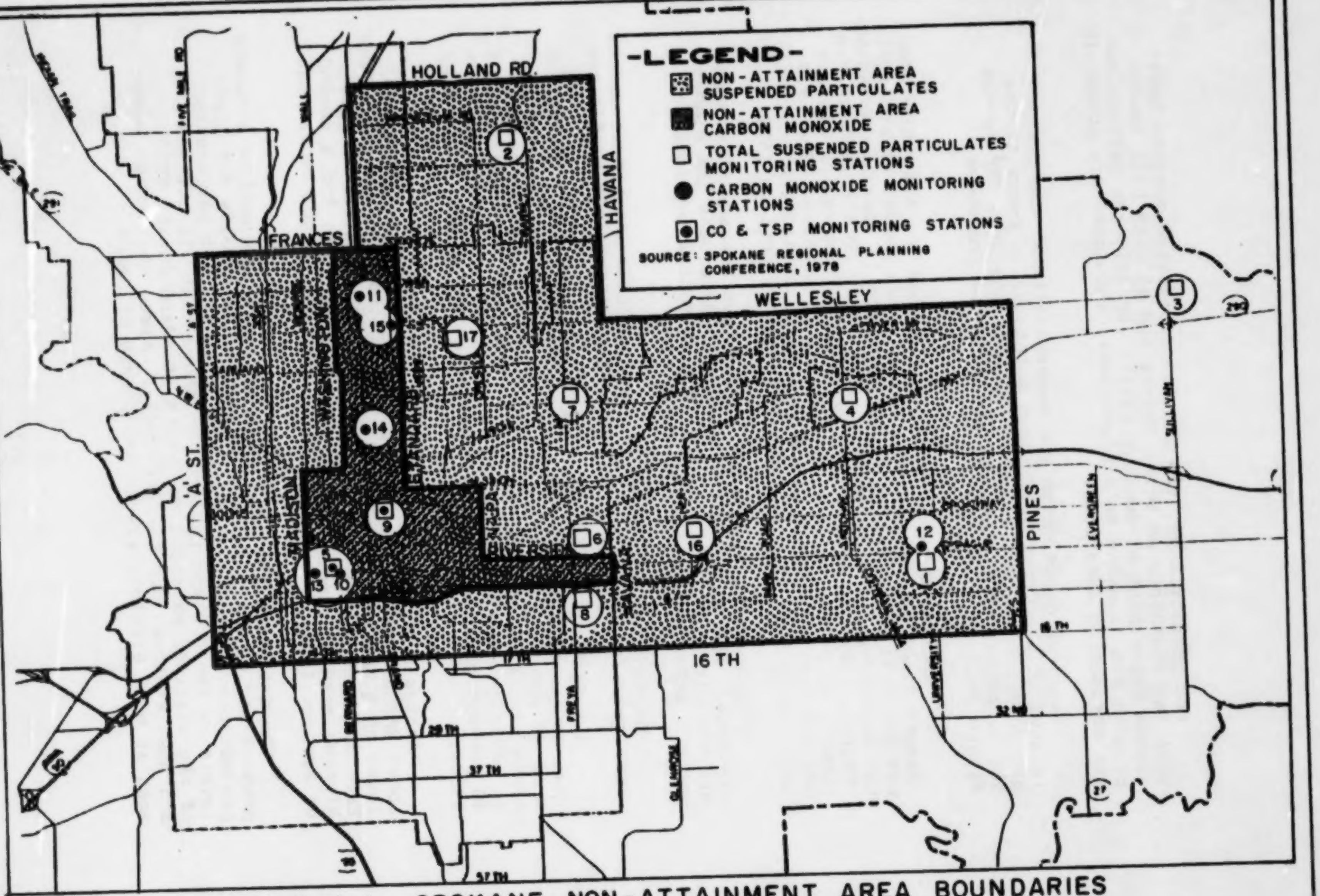
A number of stations had higher than average CO concentrations. The three that historically have been the highest are the City Hall station, the site at Monroe and Indiana, and the station at the Kershaw Building.

The majority of the violations occur in the winter months when there is the greatest frequency of stable air conditions.

A review of the 1979 DOE air monitoring data confirms that an air quality problem is present. For particulates, some 50 percent of the data samples (from quarterly measurements at 9 stations) had more than one violation of the NAAQS. In addition, the annual NAAQS (60 $\mu g/m^3$) was exceeded in 85 percent of these samples (Washington Department of Ecology 1980).

Analysis of the DOE data also shows that CO levels are above NAAQS. Present regulations state that the maximum 8-hour level of 9 ppm should not be exceeded more than once a year. Each of the stations monitored in 1979, however, had a second highest reading ranging from 10-14 ppm (Washington Department of Ecology 1980).

The data from the monitoring stations are used to evaluate present air quality, as well as serving as a basis for trend projections. Table A-4 gives the 1979 data for particulate levels in the Spokane region. It shows that all but one of the stations exceeded the state standard during 1979, and most stations did so repeatedly. Also, the annual geometric mean at most stations was in exceedence of NAAQS.



-LEGEND-
▨ NON-ATTAINMENT AREA SUSPENDED PARTICULATES
■ NON-ATTAINMENT AREA CARBON MONOXIDE
☐ TOTAL SUSPENDED PARTICULATES MONITORING STATIONS
● CARBON MONOXIDE MONITORING STATIONS
◙ CO & TSP MONITORING STATIONS
SOURCE: SPOKANE REGIONAL PLANNING CONFERENCE, 1978
HOLLAND RD.
FRANCES
HAVANA
WELLESLEY
PINES
16TH
'A' ST.
WASHINGTON
DIVISION
STANDARD
NAPA
RIVERSIDE
SULLIVAN
EVERGREEN
UNIVERSITY
BROADWAY
17TH
29TH
37TH
57TH
32ND
GLENROSE
FREYA
BERNARD
1
2
3
4
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FIGURE A-1. SPOKANE NON-ATTAINMENT AREA BOUNDARIES & LOCATION OF AIR QUALITY MONITORING STATIONS

Table A-4. Spokane TSP Air Quality - 1979

Station	Total Samples	Maximum Concentration High	Maximum Concentration 2nd High	No. days > State Standard ($>150\ \mu g/m^3$)	Maximum Annual Concentration/($\mu g/m^3$) (Annual Geometric Mean) 1975	1976	1977	1978[3]
Goodwill[1,4] Building	5	243	133	1	NA[6]	NA	NA	NA
Crown Zellerbach	57	366	315	30	80	149	131	100
University City[2]	56	472	276	9	not operating	97 operating 33 weeks	75	64
Washington Water & Power[2]	58	390	296	22	not operating	operating 33 weeks		NA
East Valley High School[2]	61	124	118	0	not operating	operating 21 weeks		NA
Cooper Elementary School[5]	30	169	124	1	not operating	operating 21 weeks		NA
Sheridan Elementary School	54	226	183	7	not operating	122 operating 21 weeks	89	63
Boone Street #2	61	266	231	12	64	83	79	71
City Hall	60	216	194	8	59	81	83	74
Millwood City Hall[2]	60	248	183	7	59	74	77	65
Kershaw Building	NA	NA	NA	NA				

---

[1] -Not shown in Figure A-1.

[2] -Located outside City limits.

[3] -Based on 8-months data.

[4] -Station established 11/1/79 (Not shown on Figure A-1).

[5] -Station discontinued 6/26/79.

[6] -NA = not applicable or no data available.

SOURCE: Spokane Regional Planning Conference 1978
and Washington Department of Ecology 1980.

The data from the CO stations (Table A-5), shows that there have been NAAQS violations from the start of the monitoring program through 1979. The 8-hour maximum of 9 ppm has been exceeded at least twice at every station.

A trend analysis of pollution for both CO and TSPs shows that until 1978 there was a general increase in levels of both pollutants. These trends are based on the maximum annual concentrations. From 1978 to 1979, however, this concentration was lower for both CO and TSP. Figures A-2 and A-3 illustrate the changes in maximum levels of pollution concentrations over the past eight years.

Non-Attainment Planning Review

The non-attainment classification for Spokane was determined through interpretation of monitoring station data. The monitoring stations showed that the NAAQS of 9 ppm CO, (over an 8-hour average) and 75 $\mu g/m^3$ of particulates (annual geometric mean) was exceeded in many sections of the City. Under federal standards, these levels should not be exceeded more than once a year, but most stations in the Spokane area exceeded them several times.

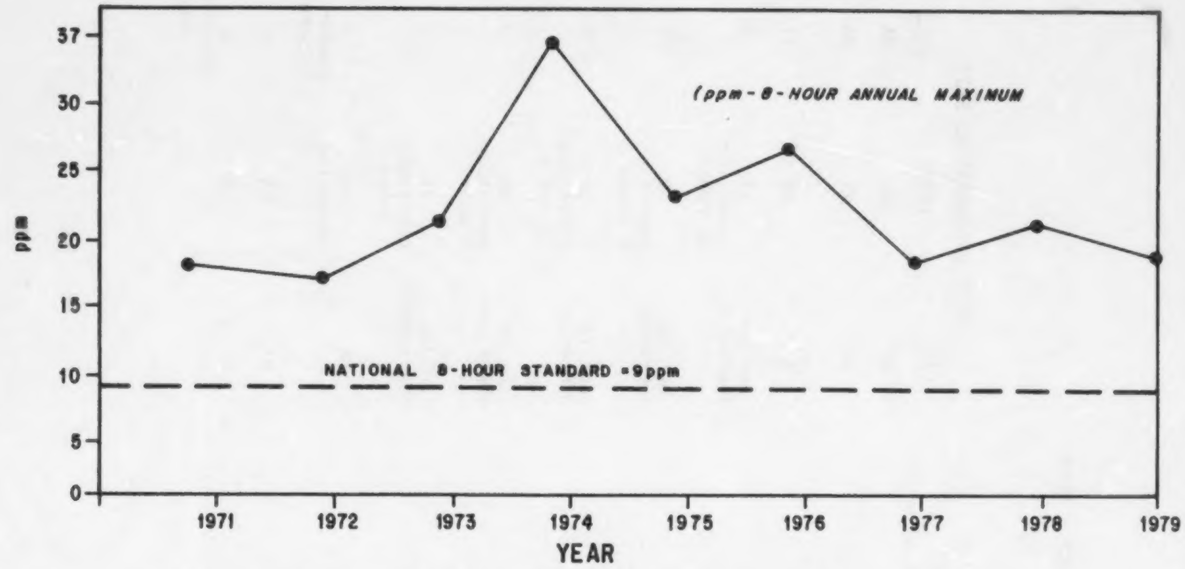
After some adjustments to reflect additional monitoring data, the non-attainment boundaries were finalized in mid-1978. Figure A-1 shows the current non-attainment areas for CO and TSP in Spokane.

Since the monitoring program began, a continuing effort has been made to locate sampling stations in areas that best reflect air quality in the area. Several stations have been discontinued and several more added to help achieve this goal. More data are needed to effectively evaluate the ozone status in this area, but the CO and TSP monitoring network appears to be sufficient to identify any present or potential problems.

The preparation of an Air Quality Plan for the non-attainment areas was required under the 1977 CAA amendments. It involves implementation of control measures (discussed in this section) that are aimed at bringing the Spokane area into conformance with NAAQS by December 31, 1982.

The Spokane Regional Planning Conference (SRPC) was designated by the governor as the lead agency in a multi-agency effort to develop and adopt the local element of the SIP. It was adopted in December of 1978 as part of the Washington State Implementation Plan.

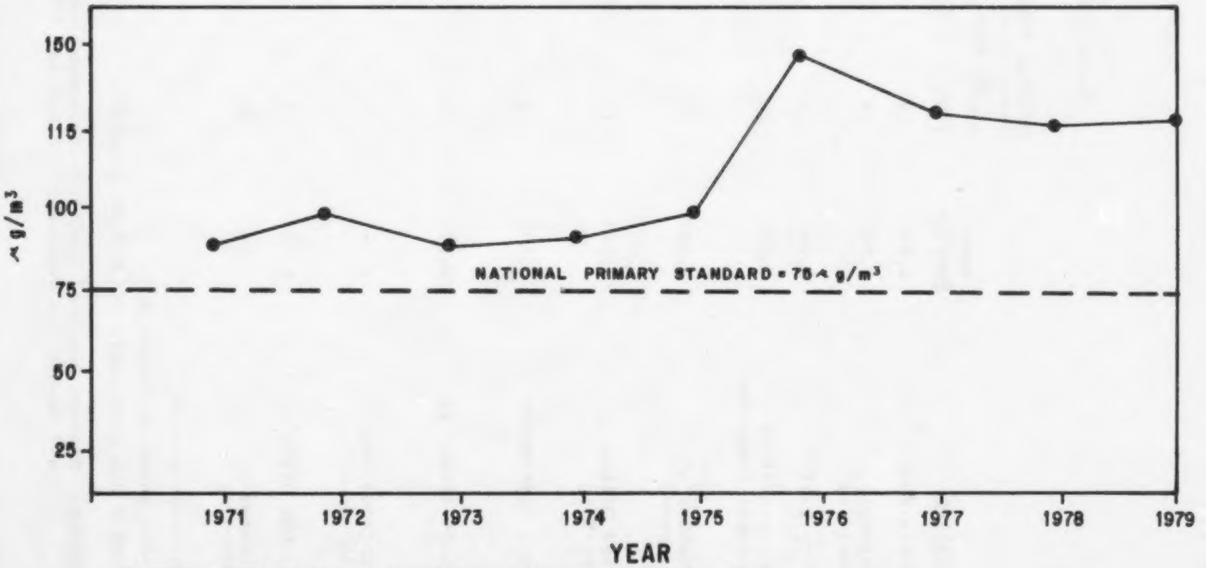
FIGURE A-2



SOURCE: Spokane County Air Pollution Control Authority, 1978

TRENDS IN MAXIMUM ANNUAL CARBON MONOXIDE CONCENTRATIONS IN SPOKANE, WASHINGTON

FIGURE A-3



SOURCE: Spokane County Air Pollution Control Authority, 1978

TRENDS IN MAXIMUM ANNUAL TOTAL SUSPENDED PARTICULATES CONCENTRATIONS IN SPOKANE, WASHINGTON (ANNUAL GEOMETRIC MEAN)

Table A-5. Spokane CO Air Quality - 1979

Station	Total Samples	Maximum 8-hr. Concentration (in ppm) High	2nd High	No. days > State Standard 9 ppm (10 mg/m^3)	Number of Violation Days 1975	1976	1977
Stolz Realty[1]	1,647	13	12	5	NA[2]	NA	NA
Fernwell Building[1]	1,757	18	14	15	NA	NA	NA
City Hall	8,060	11	10	5	35	45	27
Department of Natural Resources	3,376	12	12	6	not in operation	21 operating 22 weeks	4
Chamber of Commerce	2,152	12	11	6	not in operation	0 operating 5 weeks	1
Post Office Building	8,543	14	14	17	not in operation	50 operating 23 weeks	30
Darl Apartments	8,658	12	12	6	not in operation	26 operating 5 weeks	3
Boone Street #2	8,623	10	10	2	not in operation	71 operating 6 weeks	1
Continuation High School	2,011	12	10	2	NA	not operating	4 operating 21 weeks
Liquor Store[1]	6,483	14	14	12	NA	NA	NA
Kershaw Building	NA	NA	NA	NA	61	99	71 discontinued 1980

---

[1] -Not shown in Figure A-1.

[2] -NA = not applicable or no data available

SOURCE: Spokane Regional Planning Conference 1978 and Washington Department of Ecology 1980.

Since this time there have been updates of critical sections of the plan, namely revisions to the local Transportation Control Plan (TCP). This plan has developed concrete programs to reduce ambient levels of CO and TSP.

The primary emphasis of this analysis was to design a framework which could be accomplished within the allotted budget and time constraints, and be acceptable to EPA and DOE.

The most recent EPA update suggests that final approval of the Spokane section of SIP could be in the near future. A memo from the EPA Air Division in Seattle states that attainment of NAAQS is possible without automobile inspection and maintenance programs.

Other recent developments in Spokane include a modified parking ban, and attempts to start a new bus system by March 1981.

An important factor in the development of these plans is the active involvement of local citizens and public officials. The Spokane Air Quality Implementation Plan (AQIP) has received significant input from both groups.

Spokane City and County have both established extensive programs involving citizen committees and technical advisory committees. These include engineering and planning staff from involved agencies, including SCAPCA, SRPC and Spokane Transit System (STS) (Spokane Regional Planning Conference 1978).

Emission Reduction Relationships

The pollution reductions necessary for NAAQS attainment are based upon assumed relationships between emissions and concentrations of the involved pollutants.

Carbon Monoxide

The estimation of CO reduction is based on an EPA approved method involving distribution of 8-hour concentrations. To assure that the CO reduction is maximized, the data from the monitoring stations which exhibited the worst conditions were analyzed. In the central business district, statistical analyses were based on data from three stations, Spokane City Hall, Spokane Post Office and the Kershaw Building.

Total Suspended Particulates

The estimation of particulate reduction is based upon standard "rollback" techniques, which assume the reduction in concentration is proportional to the reduction in emissions.

Evaluation of Selection of Control Measures

CO. Using the method discussed above, a 57 percent CO reduction will be necessary in the downtown area to achieve federal standards. For the remainder of the non-attainment area, a 19 percent reduction is needed (Spokane Regional Planning Conference 1978). CO reduction strategies contained in the Spokane Transportation Control Plan are expected to result in a 59-64 percent cut in the downtown area, and a 39-48 percent reduction in the remainder of the study area. If these strategies function as planned, NAAQS attainment should be realized before the 1983 deadline (Spokane Regional Planning Conference 1978).

TSP. For the areas experiencing the worst particulate conditions, a 43 percent reduction will be necessary for NAAQS attainment. If the Transportation Control Plan measures are implemented and achieve optimum efficiency, a reduction of 50 percent is possible (Spokane Regional Planning Conference 1978). NAAQS attainment, therefore, is feasible with an efficient program.

One of the key elements of the Spokane AQIP is the selection of "legally enforceable" control measures. The City and County of Spokane evaluated and selected control measures to be implemented. SCAPCA, a regulatory agency with the authority to implement air quality regulations, was also involved in decision making. Efforts of the agencies were concentrated on control measures which could be feasibly implemented before 1983. The acquisition of much of the data used in the air quality analysis depended on close cooperation with Spokane's Traffic Engineering Department. After lengthy deliberations, a revised Transportation Control Plan was accepted in December 1979 by the Spokane City Council.

Transportation Control Plan - Measures for CO. The CAA amendments of 1977 required local areas to evaluate 19 CO control measures. The SRPC used these measures as one of its program guidelines, along with availability of funds, public acceptance and time framework considerations.

Table A-6 lists the adopted CO reduction programs in the revised TCP.

Table A-6. Control Measures for Carbon Monoxide Reduction

Description	Reduction Expected (in kg/day) CBD Area	Remainder of Non-Attainment Area	Expected Date of Implementation
FEDERAL MOTOR VEHICLE EMISSION CONTROL PROGRAM (FMVECP)	8,429.8	15,371.6	--
Joint Use Park & Ride Lots	18.4	0	ongoing
Remote Park & Ride Lots	35.0	2.1	ongoing
Fringe Parking with Shuttle Bus Service	14.8	-12.4	October 1980
On-Street Parking Controls	26.8	0	May 1981
Staggered Work Hours	60.0	0	March 1980
Improved Synchronization of Signals	96.4	0	August 1980
Major Construction Projects	1,146.2	1,224.5	varying
SUBTOTALS FOR LOCAL CONTROL MEASURES	1,397.6	1,214.2	
ADDITIONAL CONTROL MEASURES WHICH REQUIRE IMPROVED ANALYTICAL TECHNIQUES			
Additional Traffic Flow Improvements	*	*	--
Expanded Transit Marketing Program	*	*	ongoing
Downtown Transit Terminal	*	*	--
Bus Ridership Incentive Program	*	*	Fall 1980
Employer Programs to Increase Multi-Occupancy Vehicles	*	*	March 1980
Excessive Idling Controls	*	*	April 1980
Fleet Vehicle Controls	*	*	November 1980
Loading Zone Controls	*	*	June 1980
High Occupancy Vehicle Facilities	*	*	March 1980
County Enforcement of Excessive Emissions	*	*	--
SUBTOTALS FOR MEASURES 8-17	900- 1,900	50- 200	
SUBTOTALS FOR MEASURES 1-17	2,300- 3,300	1,250- 1,400	
TOTAL FOR 1-17 and FMVECP	10,700-11,700	16,600-16,800	
STATE INSPECTION MAINTENANCE	1,128.5	3,803.7	
TOTALS FOR ALL PROGRAMS	11,800-12,800	20,400-20,600	
ESTIMATE OF REDUCTION NEEDED TO MEET NAAQS	10,600	8,000	

* These programs have significant merit. However, until further analytical techniques are developed, individual program reduction data are not available.

SOURCE: Spokane Regional Planning Conference 1978.

Transportation Control Plan - Measures for Particulates. In planning for TSP reduction programs, the SRPC reviewed five general alternatives (Spokane Regional Planning Conference 1978). They include:

1. Point source compliance with existing regulations;
2. Additional point source controls;
3. Control of fugitive dust from industrial and commercial operations;
4. Control of fugitive dust from roads and parking lots; and
5. Expansion of open burning restrictions.

Although each of these areas is important, the control of dust from roads is critical. This measure includes paved roads, unpaved roads and parking lots. These sources account for 56 percent of particulate emissions (Spokane County Air Pollution Control Authority 1979). Table A-6 lists the adopted control program.

Continuing Air Quality Management Programs

Reasonable Further Progress is a term used in examining attainment toward NAAQS. It is based on a linear interpolation between existing and projected levels of carbon monoxide and particulates, with adjustments for expected implementation of control measures. When these data are transferred to a line graph, the rate of progress is evident.

Carbon Monoxide

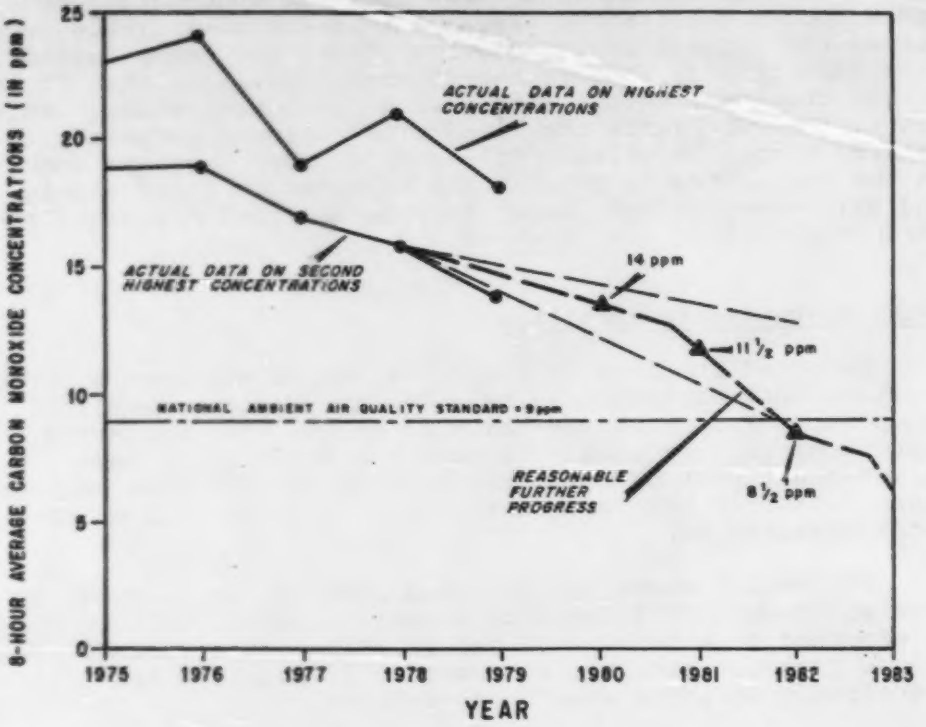
For CO level reduction, Figure A-4 shows reasonable further progress over an 8-year period. The second highest concentrations (on an annual basis) are most important since these are the values used for determining NAAQS attainment.

There are several graph lines in Figure A-4, but they all are aimed at attaining the 9 ppm level by 1983. The upper dashed line represents the expected concentrations without the implementation of the adopted control measures. Clearly, it is not sufficient to attain the federal standards by 1983.

The lower dashed line represents a proportional implementation of the revised transportation control program (TCP). This means that in a 3-year program, one-third would be implemented each year (Spokane Regional Planning Conference, 1980a). This program would be successful in meeting federal standards.

FIGURE A-4

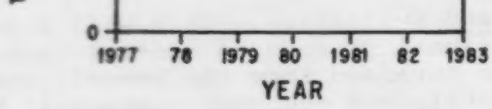
ANTICIPATED PROGRESS IN REDUCING CBD CARBON MONOXIDE LEVELS



SOURCE: Spokane Regional Planning Conference, 1980

FIGURE A-5

DEFINITION OF REASONABLE FURTHER PROGRESS FOR T.S.P.
FOR AREAS EXPERIENCING WORST CONDITIONS



SOURCE: Spokane Regional Planning Conference, 1978

The heavy dashed line shows expected concentrations based upon a qualitative assessment of the most likely benefits. During the initial implementation phase, the heavy dashed line more closely follows the upper dashed line, then drops off to the lower dashed line during the latter phase. This transition represents the "lead time" assumed necessary to realize actual benefits. For example, some programs such as the bus ridership program are expected to start slowly, and gain momentum over time (Spokane Regional Planning Conference 1980b).

Total Suspended Particulates

Expected progress in TSP reduction is based on monitoring stations that historically have had the highest levels of pollution. This strategy helps to ensure that estimated reductions will be enough to meet the NAAQS of 75 $\mu g/m^3$. An important part of this program will involve road paving, since dust from this source accounts for over half of the total measured TSP.

Figure A-5 shows the expected progress in reducing TSP levels. From a 1978 level of about 100 $\mu g/m^3$, this program is expected to attain NAAQS before 1981. This rate of reduction allows time for alternative measures if problems are confronted; therefore, the goals should be realized.

Surveillance

An integral part of Spokane's air quality implementation plan involves a series of programs to assure the attainment and maintenance of air quality standards. The four elements of this program are listed below.

Surveillance and Assessment. This involves the continuation of existing monitoring programs, development of annual emissions inventories, and studies to evaluate specific air quality problems. For TSPs steps will be taken to improve estimation of emission factors, especially fugitive dust sources. For transportation control planning for carbon monoxide, various emission and/or control measures will be completed. Some of these include the quantification of annual vehicle miles in the downtown area, and assessing the impact of specific problems such as vehicle idling and double parking.

Forecasting and Evaluation. This will determine the potential of additional or reduced control measures. Based on the information obtained form the surveillance program, social, environmental, and economic costs will be studied in detail.

Citizen and Public Official Involvement. This on-going program will be continued, including a public education segment. It will help identify the issues and explore alternatives within the scope of reasonably available resources.

Integration of CO Transportation Control Planning and TSP Planning. This will assure the continuation of the air quality planning process within existing programs. The 1979 Unified Planning Work Program, written by SRPC's Transportation Study Division, was the first step in a number of projects relevant to the implementation of the adopted control measures.

The findings of the surveillance programs will be reported in Spokane Transportation Study Division's Quarterly Progress Reports. Local agencies responsible for implementing control measures will report progress to the SRPC staff.

Appendix B

WATER QUALITY STANDARDS

NATIONAL PRIMARY DRINKING WATER STANDARDS

Type of Contaminant	Name of Contaminant	Type of Water System	Maximum Contaminant Level
Inorganic Chemicals	Arsenic	Community	0.05 mg/1
	Barium		1.
	Cadmium		0.010
	Chromium		0.05
	Lead		0.05
	Mercury		0.002
	Selenium		0.01
	Silver		0.05
	Fluoride		
	33.7°F & below		2.4
	53.8 - 58.3		2.2
	58.4 - 63.8		2.0
	63.9 - 70.6		1.8
	70.7 - 79.2		1.6
	79.3 - 90.5	Community	1.4
	Nitrate (as N)	Community & Noncommunity	10.
Organic Chemicals	Endrin	Community	0.002 mg/1
	Lindane		0.004
	Methoxychlor		0.1
	Toxaphene		0.005
	2, 4-D		0.1
	2, 4, 5-TP Silvex	Community	0.01

Total trihalomethanes [the sum of the 0.10 mg/1 concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform)] 1, 2

Turbidity	Turbidity at representative entry point to distribution system.	Community & Noncommunity	1 TU monthly average and 5 TU average of two consecutive days (5 TU monthly average may apply at state option)

1. Proposed MCL (Maximum contaminant level)
2. The maximum contaminant level for total trihalomethanes applies only to community water systems which serve a population of greater than 75,000 individuals and which add a disinfectant to the water in any part of the drinking water treatment process.

Type of Contaminant	Name of Contaminant	Type of Water System	Maximum Contaminant Level
Microbiological	Coliform Bacteria	Community & Noncommunity	Membrane Filter* Coliforms shall not exceed: 1 per 100 ml, mean of all samples per month 4 per 100 ml in more than one sample if less than 20 samples collected per month, or 4 per 100 ml in more than 5% of samples if 20 or more samples examined per month. Fermentation Tube - 10 ml portion* Coliforms shall not be present in more than 10% of portions per month, Not more than 1 sample may have 3 or more portions positive when less than 20 samples are examined per month, or Not more than 5% of samples may have 3 or more portions positive when 20 or more sample are examined per month. Fermentation Tube - 100 ml portion* Coliforms shall not be present in more than 60% of the portions per month, Not more than 1 sample may have all 5 portion positive when less than 5 samples are examined per month, or Not more than 20% of samples may have all 5 portions positive when 5 or more samples are examined per month.

* If sampling rate is less than 4 per month, compliance shall be based on 3 month period unless state determines that a 1 month period shall apply.

Type of Contaminant	Name of Contaminant	Type of Water System	Maximum Contaminant Level
Microbiological	Optional Chlorine Residual	Community & Noncommunity	Minimum free chlorine residual throughout distribution system 0.2 mg/l. (At state option and based on sanitary survey, chlorine residual monitoring may be substituted for not more than 75% of microbiological samples.)
Radionuclides Natural	Gross Alpha Activity Radium 226 + Radium 228	Community	15 pCi/l 5 pCi/l Screening level: 1. Test for Gross Alpha 2. If Gross Alpha exceeds 5 pCi/l, test for Radium 226. 3. If Radium 226 exceeds 3 pCi/l, test for Radium 228.
Man-made	Beta particle and photon radioactivity	Community	4 millirem/year for total body or any internal organ Screening level: Gross Beta Activity 50 pCi/l Tritium 20,000 pCi/l Strontium 90 8 pCi/l If Gross Beta exceeds 50 pCi/l, sample must be analyzed to determine major radioactive constitutes present; and the appropriate organ and total body doses shall be calculated to determine compliance with the 4 millirem/year level.

PRIORITY POLLUTANTS LISTED IN THE CLEAN WATER ACT

Metals (And Metallic Compounds)
Antimony and compounds
Arsenic and compounds
Beryllium and compounds
Cadmium and compounds
Chromium and compounds
Copper and compounds
Lead and compounds
Mercury and compounds
Nickel and compounds
Selenium and compounds
Silver and compounds
Thallium and compounds
Zinc and compounds
Aromatic Hydrocarbons
Acenapthene
Benzene
Ethylbenzene
Fluoranthene
Napthalene
Toluene
Other aromatic hydrocarbons
Chlorinated Hydrocarbons
Chlorinated naphthalenes
Dichlorobenzenes
Other chlorinated benzenes
Dichloroethylenes
Chlorinated ethanes
Dichloropropane and dichloropropenes
Hexachlorobutadiene
Hexachlorocyclopentadiene
Polychlorinated biphenyls
Tetrachloroethylene
Trichloroethylene
Vinyl chloride

Halomethanes
Carbon tetrachloride
Chloroform
Other halomethanes
Phenols
2—chlorophenol
2, 4—dichlorophenol
Pentachlorophenol
Other chlorinated phenols
2,4—dimethylphenol
Nitrophenols
Phenol
Other phenols
Pesticides
Aldrin/Dieldrin
Chlordane and metabolites
DDT and metabolites
Endosulfan and metabolites
Endrin and metabolites
Heptachlor and metabolites
Hexachlorocyclohexane
Toxaphene
Other pesticides
Others
Acrolein
Acrylonitrile
Asbestos
Benzidine
Chloralkyl ethers
Cyanides
Dichlorobenzidine
Dinitrotoluene
Diphenylhydrazine
Haloethers
Isophorone
Nitrobenzenes
Nitrosamines
Phthalate esters
2,3,7,8—tetrachlorodibenzo-p-dioxin (TCDD)

Appendix C

URBAN RUNOFF CONTROL RECOMMENDATIONS CONTAINED IN THE SPOKANE AQUIFER 208 PLAN

III.3 Preventive Management Strategies for Control of Pollutants in Stormwater Runoff

BACKGROUND:

For most areas outside the City of Spokane and some areas within, the principle method of disposal of stormwater runoff is to the ground by seepage basins. Stormwater runoff from urbanized areas does carry contaminants and contributes a significant portion of the pollutants from man's activities on the ground surface. Activities in urbanized areas were shown in the Cause and Effect Report to cause degredation of the aquifer water quality. A significant portion of the potential pollutant contribution from residential urbanization including localized commercial and public services is contained in stormwater runoff from streets and other impervous areas. Runoff from industrial development and regional commercial development contains additional pollutants which may enter the aquifer.

ISSUE:

Three major issues are important. First, how strongly should preventive management strategies for pollutants in stormwater runoff be supported? Second, in developing areas, how much should runoff pollutants, volume and peak flow be reduced in new development? Third, in developed areas, how strongly should operational changes in stormwater management be supported to protect water quality?

The RECOMMENDED POLICY is:

III.3A For overall runoff management

Support management of wasteloads in runoff to protect water quality throughout the Aquifer Sensitive Area simultaneously with additional research.

The RECOMMENDED ACTIONS for Implementation are:

III.3A.01 Where economically feasible convey stormwater to disposal where it will not impact the aquifer water quality.

.02 Establish a planning objective that a minimum of 80% of annual runoff from all impervious areas disposed of to the ground be introduced through grassed percolation areas.

.03 Appropriate agencies shall when reviewing for approval proposals for improvements and new development require consideration of measures to mitigate stormwater runoff contamination.

.04 Appropriate agencies initiate programs of vacuum sweeping for paved surfaces.

.05 Additional studies of stormwater contamination potential should be undertaken to better quantify the problem and the effectiveness of mitigating measures.

III.3A.06 A pilot project should be undertaken to evaluate the use of porous pavement in parking lots.

.07 Initiate an education program which informs the public of problems associated with runoff, eg., use of fertilizers, pesticides, herbicides, solvents and petroleum products, etc.

.08 The implementing agencies should coordinate control strategies with the Spokane County Air Pollution Control Authority. An approved site drainage plan must be prepared for parking lots required to be paved.

The RECOMMENDED POLICY is:

III.3B For runoff management in developing areas:

> *Support measures to reduce the input of contaminants from runoff as well as reducing volume and peak flow in new developments to prevent aquifer water quality problems.*

The RECOMMENDED ACTIONS for Implementation are:

III.3B.01 The appropriate agencies shall adopt regulations which require consideration of innovative development schemes for the dispersion of runoff in accordance with overall runoff management for new developments. For example, Planned Unit Development and campus type commercial and industrial developments.

.02 The appropriate agencies shall develop regulations for the control of runoff in new developments. Due to the types of materials which may be stored or handled in commercial and industrial areas these sites may require special attention. The regulations should include:

A. require grading and drainage plans for lots and streets which maximize runoff retention on site and disposal to grass percolation areas;

B. require site plans and easements which describe the grassed percolation areas to be used for those portions of private property planned for acceptance of public drainage;

C. the appropriate agency shall develop specifications for grassed percolation areas, and the disposal methods approved for the excess over the capacity of the percolation area;

D. require that retention or settling basins, where employed, be impervious with overflow to an approved treatment or dispersion system;

E. require certification by a licensed Engineer, or other appropriate developer representative, that grading, drainage and site plans have been complied with during development and construction. The developer shall be responsible for this certification before occupancy is allowed;

F. require covenants or deed restrictions publically enforceable which prohibit alteration or filling in of grassed percolation areas. Owners shall provide maintenance of the areas for their intended use but easements for access by maintenance personnel shall be provided. Require that the conditions imposed on the approval of drainage and grading plans shall become public enforceable covenants or deed restrictions. These covenants or deed restrictions shall be in force in perpetuity;

G. in parking lots with limited use parking, consideration should be given to paving the travelled way only, leaving the parking stall unpaved. This approach should be employed only if grassed percolation areas are not possible;

H. require that the plans developed for commercial and industrial areas make special provision for handling runoff which may contain materials which pose a special threat to aquifer water quality degradation, e.g., loading or material transfer areas;

I. all building and occupancy permits shall be accompanied by a pamphlet summarizing the recommended runoff control strategies. The availability of drainage planning assistance to individuals and small businesses shall be outlined.

J. require public agencies which participate in capital improvement projects to adopt and implement regulations and policies which follow runoff management concepts; and

K. control runoff during periods of construction in order to preserve the effectiveness of the approved drainage plan.

The RECOMMENDED POLICY is:

III.3C For runoff management in developed areas:

Support cost effective operational changes in stormwater systems management in developed areas to protect water quality.

The RECOMMENDED ACTIONS for Implementation are:

III.3C.01 The City of Spokane Combined Sewer Overflow Abatement Project should include interception of stormwater discharges to the ground over the aquifer where possible.

.02 Development of lots within existing developed areas should incorporate pertinent strategies for developing areas and should be referred to the appropriate agency for specific control measures.

.03 The drainage disposal methods used in connection with street improvements in existing developed areas shall to the extent practicable incorporate the strategies enumerated under "A. overall runoff management".

.04 A demonstration program for urban runoff is needed to develop new means to solve drainage problems, to develop practical designs and to train local personnel in implementation techniques. Local (development administration), State (state groundwaters) and Federal (sole source administration) interests will be served by such a program and should each participate in its cost.

Appendix D

ECONOMIC, HOUSING AND FISCAL CONDITIONS AND PROJECTIONS

APPENDIX TO THE
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
COUNTYWIDE WASTEWATER MANAGEMENT PLAN

Prepared by

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OVERVIEW OF THE SPOKANE COUNTY ECONOMY

Importance of an Economic Overview

One mandate of an environmental impact statement is to examine the growth-inducing impacts of the proposed project for which it is prepared; in this case, of the Spokane County Countywide Wastewater Management Plan (CWMP). The questions that must be answered to satisfy this mandate are "How much growth would occur in the absence of the project?" and "How much growth would occur if the project is completed?"

Wastewater treatment facilities enable growth to occur for several reasons. First, they allow development at greater densities than would be acceptable with septic systems or other onsite means of wastewater treatment and disposal. Second, they allow development to occur in places where soils or other conditions prohibit onsite treatment and disposal.

While such facilities enable growth to occur, however, they do not cause growth where other stimuli are not present. Historically, economic factors - such as the presence of natural resources or the expectation of employment opportunities - have been the primary stimuli for population growth of a geographic area. Permanent settlements have been established to take advantage of agricultural lands, forests, mineral deposits, natural harbors and trade routes. People have moved to established settlements in order to accept or seek employment. (In the twentieth century, retirement has joined employment as an important reason for interregional population movement.) Because economic factors play such a major role in population growth, examination of the regional economy of Spokane County provides a basis for answering questions about the amount of growth that would occur with and without the CWMP.

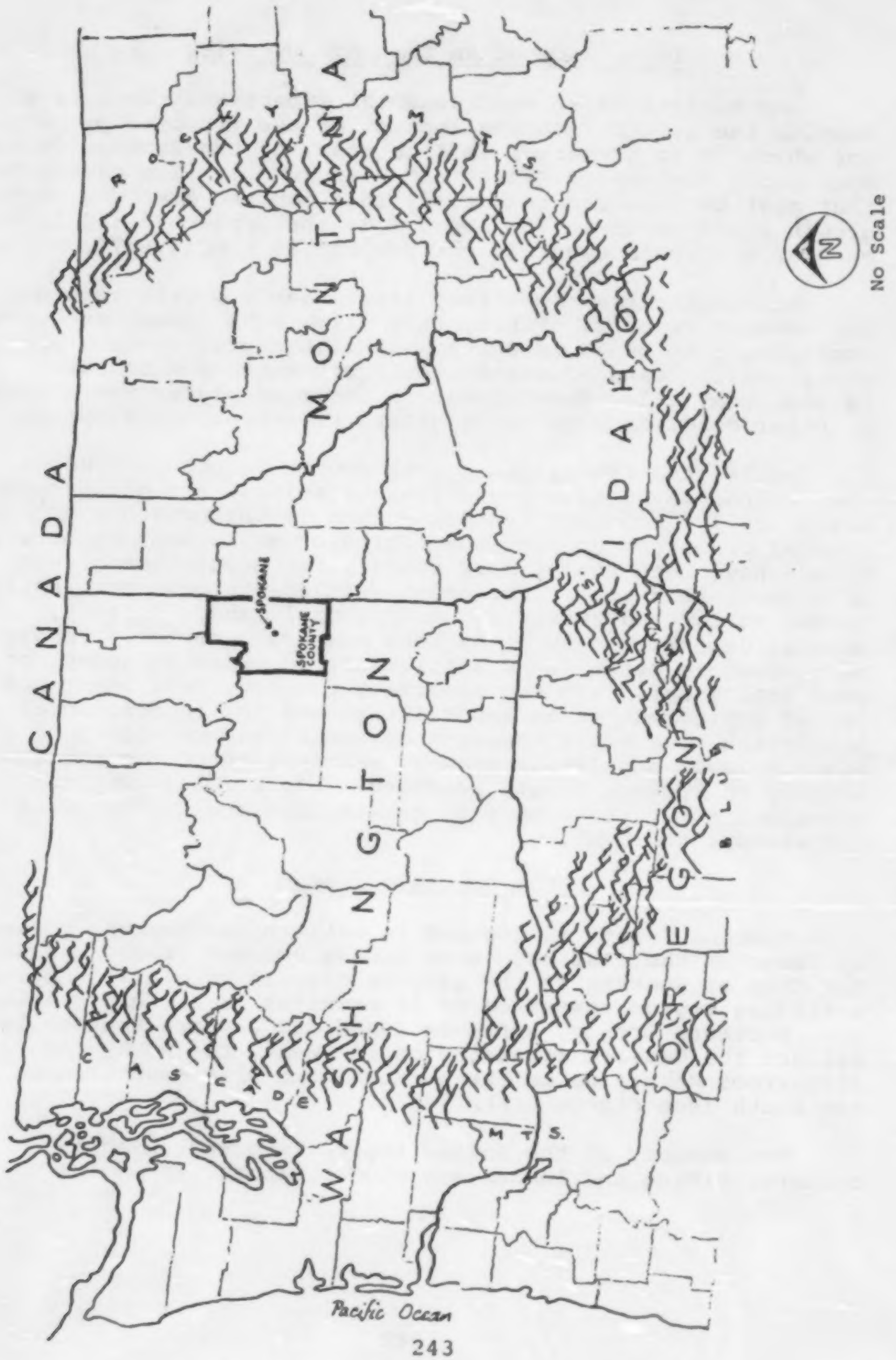
The Economic Region

Spokane County is located in eastern Washington, bordered by Idaho on the east and about midway between Oregon and Canada. The City of Spokane is the largest city in the Inland Empire, a trading region comprised of 36 counties in eastern Washington, northern Oregon, northern Idaho and western Montana lying between the Cascade Mountains on the west, the Rocky and Bitterroot Mountains on the east and the Blue Mountains on the south (see Figure D-1).

The economy of the Inland Empire is based on agriculture, mining and lumber and wood products.

Figure D-1

THE INLAND EMPIRE



Source: Spokane Area Development Council

Agricultural activity in the region includes crop production - including wheat, apples, potatoes, sugar beets, lentils, alfalfa hay, lawn grass seed, hops, dry peas and beans and lawn seed - and livestock as well as food processing. Mining, which is centered in the Idaho counties, focuses on silver, lead and zinc. The Inland Empire lumber industry produces about 10 percent of the United States' softwood lumber.

The Spokane County Economy

Spokane County shares in the agricultural production of the Inland Empire, but its major role is that of a service center for the agriculture-, mining- and lumber-based industries of the region. Wholesale and retail trade, services and government are the most important economic sectors in terms of employment, accounting for two-thirds of all non-agricultural wage and salary jobs in the county in both 1970 and 1979. The distribution of employment by industry in Spokane County in those years is presented in Table D-1. Agricultural employment numbered about 400 in 1979.

Table D-1

NON-AGRICULTURAL WAGE AND SALARY EMPLOYMENT BY INDUSTRY,* 1970 AND 1979

	1970		1979		Av. Annual % Change, 1970-1979
Industry	Number	%	Number	%	
Mining/Forestry	300	0.3	700	0.6	9.9
Contract Construction	4,700	5.2	7,300	5.7	5.0
Manufacturing	12,600	14.0	18,400	14.4	4.3
Transportation/Public Utilities	7,400	8.2	7,800	6.1	0.6
Trade	23,400	26.0	36,100	28.2	4.9
Finance, Insurance, Real Estate	5,300	5.9	8,000	6.3	4.7
Services	18,600	20.6	28,000	21.9	4.6
Government	17,800	20.0	21,700	17.0	2.2
TOTAL	90,100	100.0	128,100	100.0	4.0

Note: Detail may not add to total because of rounding.
*Excludes agricultural workers and self-employed. These workers numbered approximately 14,200 in 1970 and 11,400 in 1979.

Source: Spokane Area Development Council, Labor Force (Annual Average) Employment and Unemployment, Spokane County (summary of Washington State Employment Security Department data).

Table D-1 indicates that total employment grew at an average annual rate of 4.0 percent during the nine-year period, and that this rate was equaled or exceeded by every sector except transportation-public utilities and government. The greatest growth rates occurred in mining-forestry, contract construction and trade; trade experienced the greatest numeric increase with the addition of 12,700 jobs.

Recent Trends in Spokane County Employment

The most important influence on the Spokane County economy during the 1970's was EXPO '74. Preparation for and presentation of EXPO stimulated employment growth between 1972 and 1974. The Washington State Employment Security Department estimates that average employment increased by about 4,500 jobs between 1973 and 1974. Between 7,000 and 10,000 jobs were created during the fair's six-month peak operation period. The immediate effects of the fair had waned by 1975, however, and the county's economy again began to reflect national conditions. Employment decreased between 1974 and 1975 with the departure of EXPO and the effects of the national recession. Average total employment in 1975 was actually less than the pre-EXPO 1973 average, as shown in Figure D-2.

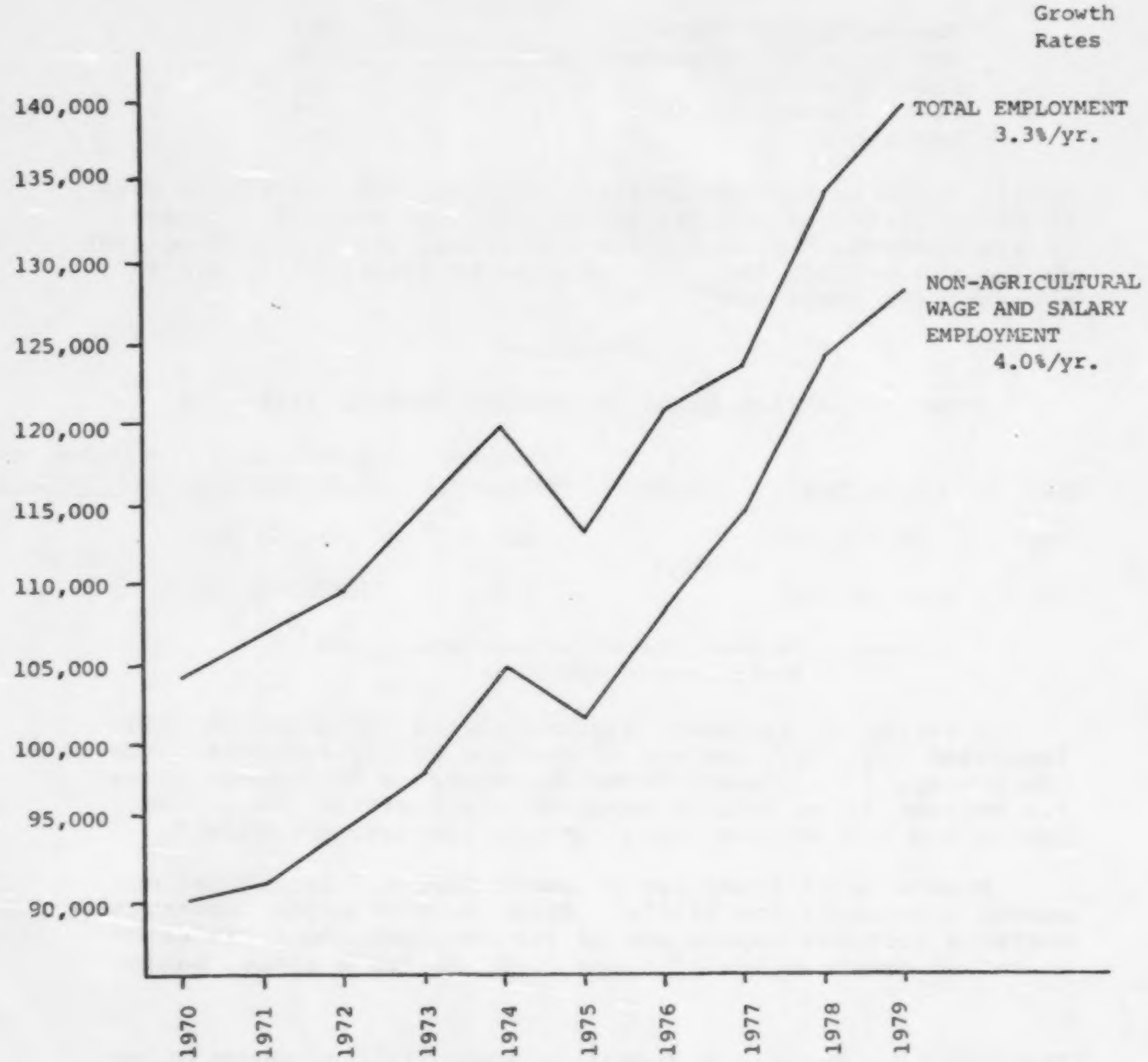
Since the fair, Spokane County has experienced steady employment growth, and non-agricultural wage and salary employment has grown at a rate greater than the growth of the pre-EXPO period. During 1970-74, total employment grew at an average rate of 3.5 percent per year and non-agricultural wage and salary employment at an average rate of 3.9 percent per year. During 1974-79 (which includes the employment decrease of 1975), total employment increased at an average rate of 3.1 percent per year and non-agricultural wage and salary employment at a rate of 4.1 percent per year. Since 1974, growth has been concentrated in trade (increase of 7,500 jobs), services (4,500 jobs) and manufacturing (4,000 jobs).

Characteristics of Major Economic Sectors

The following paragraphs describe the primary characteristics of Spokane County's largest economic sectors. Estimates of employment at major firms were drawn from information provided by the Spokane Area Development Council.

Figure D-2

EMPLOYMENT IN SPOKANE COUNTY, 1970-1979



Note: Data for 1970 are not strictly comparable with later years because of a methodology change.

Source: Spokane Area Development Council (from Washington State Employment Security Department) kane County grew from 23,400 in 1970 to 28,000 in 1979, an average annual increase of 4.6 percent. Major employers in this sector are:

Firm	Number of Employees
Rosauer's Supermarkets	907
The Crescent department store	750
Safeway Stores	650
J. C. Penney and Co.	606
URM stores	442

Retail sales in Spokane County grew from $838,729,000 in 1971 to an estimated $1,935,343,550 in 1978, an overall increase of 130 percent. Adjusting for inflation, which was 68 percent during the period, the real increase in retail sales was 43 percent (see Table D-2).

Table D-2

GROWTH OF RETAIL SALES IN SPOKANE COUNTY, 1971-1978

Year	Retail Sales	% Change	Consumer Price Index	Retail Sales in 1971 Dollars	% Change in 1971 Dollars
1971	$ 838,729,000	130.7	121.3	$ 838,729,000	43.2
1978	1,935,343,550		195.4	1,201,418,490	

Source: Spokane Area Development Council and Gruen Gruen + Associates

A survey of shoppers' license plates conducted in 1979 indicated that 72.5 percent of Spokane County shoppers lived in the county, 13.5 percent lived elsewhere in Washington State, 8.5 percent lived outside Washington but within the Inland Empire and 5.5 percent lived outside the Inland Empire.*

Expansion of trade sector employment and facilities occurred throughout the 1970's. Prior to EXPO major construction projects included expansions of The Crescent and a URM warehouse and construction of a new J. C. Penney's store, Lamont's apparel store, Nordstrom's department store, Skagg's Thrifty City and Fairwood Shopping Center. Post-EXPO projects have included the downtown skywalk developments and expansion of Rosauer's, Nordstrom's, University Shopping Center and Riverpark Square.

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*This survey was conducted by students at Spokane Falls Community College and reported by the Spokane Area Development Council. Place of automobile registration, as indicated by the license plates, was used as a surrogate for shopper's residence.

Services. Employment in services grew from 18,600 in 1970 to 28,000 in 1979, a 50.6 percent increase at an average annual rate of 4.6 percent. Health services is the largest subsector, accounting for approximately 40 percent of service employment in 1978. Major service sector employers in Spokane County are:

Firm	Number of Employees
Spokane School District 81	2,386
Sacred Heart Hospital	2,051
Deaconess Hospital	1,092
Holy Family Hospital	515
Gonzaga University	500

In addition to medical services, this sector includes activities such as hotels and motels; personal services; business services such as advertising, computer and data processing services and consulting services; commercial recreation and amusement, including movies; auto and other repairs; legal services; education; and social services including job training and child day care.

Government. Government employment in Spokane County increased from 17,800 in 1970 to 21,700 in 1979, an average annual growth rate of 2.2 percent. The largest government sector employers in the county are:

Employer	Number of Employees
Fairchild Air Force Base	4,805
United States Government	3,800
State of Washington	3,054
City of Spokane	2,236
Spokane County	1,100

Manufacturing. Manufacturing is the fourth largest sector in Spokane County in terms of employment. It grew from 12,600 jobs in 1970 to 18,400 in 1979, a 46 percent increase at an average rate of 4.3 percent per year. Major manufacturing employers in Spokane County are:

Firm	Number of Employees
Kaiser Aluminum	3,660 (2 plants)
Key Tronic Corp.	1,135
Cowles Publishing Co.	706
American Sign & Indicator Corp.	680
Columbia Lighting, Inc.	647

Inexpensive power, made available by the Bonneville Power Administration as a result of numerous hydroelectric projects, has historically been an important factor in attracting power-demanding industries such as Kaiser to the Inland Empire. More recently, Spokane County has "been noticed" by growth industries such as the minicomputer firms that inhabit California's Silicon Valley and the industries that support them (Walsh, pers. comm.). Key Tronic Corporation and Hewlett-Packard, which has recently established operations in Spokane County, are examples of this new type of development.

Fire, Insurance and Real Estate. Employment in this sector grew from 5,300 in 1970 to 8,000 in 1979, an overall increase of nearly 51 percent. Major employers are:

Firm	Number of Employees
Old National Bank	864
Seattle First National Bank	425
Washington Trust Bank	360
Fidelity Mutual Savings Bank	220

Spokane County has 11 commercial banks and eight savings and loan associations (some of which have multiple branches) as well as 46 credit unions. The yellow pages of the telephone book contain 15 pages of insurance listings and over 10 pages of real estate listings.

Transportation and Public Utilities. Employment in this sector grew by only five percent during the 1970-79 period, from 7,400 in 1970 to 7,800 in 1979. Major employers are:

Firm	Number of Employees
Burlington Northern	2,200
Pacific Northwest Bell	1,350
Washington Water Power Co.	921
Union Pacific Railroad	300

The economy of Spokane County has historically been linked to both transportation and utilities. Early industries - a lumber mill and a flour mill - located in Spokane Falls to take advantage of the hydroelectric power it generated. Washington Water Power later located at the falls for the same reason. Another reason for the City of Spokane's location is its proximity to the lowest pass through nearby mountains in Idaho; this pass was the only one maneuverable by the railroads. Burlington Northern currently maintains a major classification (car-sorting) yard in Spokane County.

Spokane County as a Service Center

To establish the function of Spokane County as a service center for the Inland Empire requires a demonstration that some of the services it provides - including trade and finance-insurance-real estate as well as the defined "services" sector - are used by non-county residents. One method for analyzing such a pattern is to compare the structure of the Spokane County economy, as indicated by the distribution of employment by sector, to that of the nation as a whole. The rationale behind this approach, known as location quotient analysis, is explained in the next section, and the comparison is made in the following section.

Location Quotient Analysis. Economists suggest that the economic activities of an area may be separated into two groups: basic activities and local-serving industries. This distinction is important in explaining why and how the area grows. The basic activities are those which provide the area's economic foundation by bringing in money from other regions; for example, mining of minerals, production of agricultural crops or manufacture of materials or goods (steel, aluminum, airplanes) which are sold to other parts of the country. Because they bring money into the area, these activities are also known as export industries even though they may serve non-local residents who travel to the area; for example, tourism is an export (or basic) industry.

Local-serving activities are the industries that develop to serve the people engaged in basic activities. Miners, farmers and factory workers demand food, clothing, housing and services (banking, insurance, recreation); this demand is satisfied by the employment of other workers to provide the needed goods and services.

Each economic sector (or industrial activity) is comprised of both basic and local-serving components. For example, food processing includes both canneries (export activity) and bakeries (local activity); trade includes sales to out-of-county residents and businesses (export) and within-county customers (local-serving); major hospitals provide health services to both non-local and local populations. One method that is used to estimate the sizes of the two components in each sector - and thereby define the economic base of the area - is location quotient analysis.

Location quotient analysis is based on two fundamental assumptions: (1) that the United States economy is essentially self-contained and (2) that regional demand patterns are similar to the national demand patterns. Using the first assumption, it hypothesizes that economic activity in the nation as a whole is local-serving, because we produce the goods and services that meet our own demands. Using the second assumption, it hypothesizes that if the proportion of employment in a given industry in a geographic region is the same as that for the nation as a whole, then that industry is exactly local-serving for the region, because the region demands that proportion of its needs from the given industry. If the local proportion of employment in an industry exceeds the national proportion, then some of the industry's output is exported to meet demand from other regions; if the local proportion is smaller than the national proportion, the region must satisfy the unmet demand by purchasing goods or services from other regions. The location quotient is an index of the comparative local (regional) and national proportions of employment in an industry.

Although the preceding paragraph refers to the comparative distribution of employment, location quotients may also be derived by using income-by-industry data. Any difference between the employment location quotient and the income location quotient may be explained by a difference in wage rates for various industries among regions. This analysis uses employment location quotients.

The employment location quotient is calculated with the following formula:

$$\text{Location Quotient} = \text{Proportion of local workers in industry x} \div \text{Proportion of national workers in industry x}$$

This equation may also be expressed as:

$$\text{Location Quotient} = \frac{\text{number of local employees in industry x}}{\text{total local employees}} \div \frac{\text{number of national employees in industry x}}{\text{total national employees}}$$

A resulting location quotient of 1.0 indicates that the local and national proportions of employment in industry x are the same and therefore implies that local demand is exactly satisfied. A location quotient greater than 1.0 indicates that some "extra" output from industry x is available for export, while a result smaller than 1.0 indicates that the local area must turn to other areas to satisfy its demand for that industry's output.

For example, in 1979, total national employment was 89,497,000; of those workers, 20,140,000 were employed in trade. In Spokane County, 36,100 out of a total 128,100 workers were employed in trade. The location quotient for trade in Spokane County was therefore 1.254, as shown below:

$$LQ = \frac{36,100}{128,100} \div \frac{20,140,000}{89,497,000} = \frac{.282}{.225} = 1.254$$

Thus, it may be concluded that Spokane County has some employment in trade that is basic activity, serving people and businesses from outside the county.

How much of the trade activity (or employment) in Spokane County is basic activity? The analysis may be carried one step further to derive an estimate of the proportion of an industry's output that is basic (exported) by using the following formula:

$$\text{Basic Component} = \frac{\text{Location Quotient} - 1.0}{\text{Location Quotient}}$$

In the trade example presented above, the basic component would be 20.3 percent:

$$\text{Basic Component} = \frac{1.254 - 1.0}{1.254} = .203$$

In other words, about four-fifths of the trade employment in Spokane County is local-serving, while just over one-fifth meets demand generated outside the county.

Comparison of National and Spokane County Employment Patterns. Table D-3 presents estimates of the proportion of non-agricultural wage and salary workers in each industry in the United States and Spokane County in 1970 and 1979. The data indicate that in 1970 the county had greater proportions of employees than did the nation in every sector except mining and manufacturing. By 1979, the proportion of government employment in the county was reduced below the national proportion.

Table D-3

PERCENTAGE DISTRIBUTION OF NON-AGRICULTURAL WAGE AND SALARY WORKERS BY INDUSTRY FOR THE UNITED STATES AND SPOKANE COUNTY, 1970 AND 1979

	1970		1979	
Industry	U.S.	Spokane County	U.S.	Spokane County
Mining	0.9	0.3	1.1	0.6
Contract Construction	4.7	5.2	5.2	5.7
Manufacturing	27.4	14.0	23.4	14.4
Transportation/Public Utilities	6.4	8.2	5.8	6.1
Trade	21.2	26.0	22.5	28.2
Finance, Insurance, Real Estate	5.2	5.9	5.6	6.3
Services	16.4	20.6	19.1	21.9
Government	17.8	20.0	17.5	17.0
TOTAL	100.0	100.0	100.0	100.0
Total Non-agricultural Wage and Salary Workers	70,664,000	91,100	89,497,000	128,100

Note: Detail may not add to total because of independent rounding.

Sources: Table D-1; U. S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, June 1980 (pp. S-11 and S-12); U. S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics 1971 (page 80).

Table D-4 shows location quotients and basic components for each industry for Spokane County for 1970 and 1979. The table indicates that the difference between Spokane County and national proportions of employment in trade increased between 1970 and 1979. In 1970, the location quotient for trade was 1.226; by 1979, it had grown to 1.254 and the proportion of employment devoted to export activity had grown from 18.4 percent to 20.3 percent.

Table D-4

EMPLOYMENT LOCATION QUOTIENTS FOR SPOKANE COUNTY
1970 AND 1979

	1970		1979	
Industry	Location Quotient	% of Output Exported	Location Quotient	% of Output Exported
Mining	0.333	*	0.545	*
Contract Construction	1.106	9.6	1.096	8.8
Manufacturing	0.511	*	0.615	*
Transportation/Public Utilities	1.281	21.9	1.052	4.9
Trade	1.226	18.4	1.254	20.3
Finance, Insurance, Real Estate	1.135	11.9	1.125	11.1
Services	1.256	20.4	1.147	12.8
Government	1.124	11.0	0.971	*

*Assumed to be a net importer of this product or service.

Sources: Tables D-1 and D-3

In other sectors, the differences between Spokane County and national employment patterns lessened between 1970 and 1979. In construction, transportation-public utilities, finance-insurance-real estate and services Spokane County employment remained above the national proportion but the differences were smaller in 1979 than in 1970. The location quotient for construction declined from 1.106 to 1.096, for transportation-public utilities from 1.281 to 1.086, for finance-insurance-real estate from 1.135 to 1.125 and for services from 1.256 to 1.136.

Mining and manufacturing shares of county employment also tended toward the national shares: the location quotient for mining increased from 0.333 to 0.545 and for manufacturing from 0.511 to 0.615. In government, the location quotient fell from 1.124 in 1970 to 0.971 in 1979, indicating that by the latter year government employment in Spokane County had declined below the national average.

Future Economic Conditions

At the beginning of this chapter, a question was posed about how much growth would occur in Spokane County with and without the facilities identified in the CWMP. The amount of growth, it was stated, is likely to be related to economic factors, because it is economic activity that has historically stimulated population growth. Therefore, a look at projected economic conditions in Spokane County will provide insight into the magnitude of growth that may be expected. Before examining specific projections that have been prepared, however, it is useful to review the different methods that may be used to develop them. This review follows, and the examination of projections that have been prepared begins on page 262.

Methods for Developing Projections

A projection of economic conditions - or of a specific economic indicator, such as employment - draws on information about past and current conditions in order to predict the future. The particular aspect of those conditions considered, the extent to which their relationship to other factors in the environment is also examined and the interpretation of what happened to those factors and relationships over time can all affect the outcome of the projection. The differences may be illustrated by developing some sample analyses of the employment data for Spokane County shown in Table D-5.

Table D-5

TOTAL EMPLOYMENT IN SPOKANE COUNTY IN SELECTED YEARS

Year	Employment
1979	139,500
1978	133,900
1977	123,300
1976	120,600
1975	113,000
1974	119,800
1973	114,900
1972	109,600
1971	107,200
1970	104,300
1965	91,300
1960	91,800

Source: Spokane Area Development Council

Extrapolating from Historical Data. A simple projection method is to calculate the numeric increase in employment during a "base period" and predict that the same rate of numeric increase will continue in the future. Table D-6 illustrates this procedure, showing that the starting and ending dates for the base period also affect the outcome.

Table D-6

SAMPLE EMPLOYMENT PROJECTIONS BASED ON NUMERIC INCREASE

Base Period	Total Numeric Increase	Average Annual Numeric Increase	Projected Employment in Year 2002
1960-1979	47,700	2,510	197,230
1970-1979	35,200	3,910	229,430
1975-1979	26,500	6,625	291,875

Source: Data presented in Table D-5

The application of numeric increase rates, as shown in Table D-6, implicitly assumes that the amount of employment growth is not affected by the amount of employment at the beginning of a period; for example, based on the 1970-1979 period, that 3,910 jobs will be added in 1980, when there are 139,500 existing jobs and also in 1999, when there are 217,700 existing jobs. A second method of projection, which considers the average annual percentage change rather than the average annual numeric change, relates the change to the size of the existing job base as well as to historical experience. This method is illustrated in Table D-7, which also presents a comparison of the results of the two procedures.

Table D-7

SAMPLE EMPLOYMENT PROJECTIONS BASED ON AVERAGE ANNUAL PERCENT CHANGE

Base Period	Average Annual Percent Increase	Projected Employment in Year 2002	Projected Employment in Year 2002 From Table D-6
1960-1979	2.23	231,500	197,230
1970-1979	3.28	293,300	229,430
1975-1979	5.41	468,460	291,875

Note: Details may not agree because of independent rounding.

Source: Tables D-5 and D-6

This latter approach incorporates information about both historical growth and the size of the employment base. An additional factor that it does not consider is employment growth outside the specific area under study (in this case, Spokane County). Would an increase of 153,800 jobs (from 139,500 in 1979 to 293,300 in 2002) account for most of the employment growth in the State of Washington during the projection period, or a small amount of the expected total? Some methods of projection examine the relationship between employment in the local area and employment in the state or the county as a whole to estimate future local job growth. Table D-8 illustrates this procedure.

Table D-8

SAMPLE EMPLOYMENT PROJECTIONS BASED ON RELATIONSHIP BETWEEN COUNTY AND STATE EMPLOYMENT

Base Year	Employment in Washington State	Employment in Spokane County	County as % of State	County Employment Projection for Year 2002*
1970	1,281,000	104,300	8.14	146,170
1975	1,388,000	113,000	8.14	146,170
1979	1,647,000	139,500	8.47	152,100

*State employment estimated at 1,795,700, extrapolated on an average annual percentage growth basis from OBERS projections of 1,781,600 in 2000 and 1,918,200 in 2020.

Sources: State employment figures from State of Washington Employment Security Department (pers. comm. to Gruen Gruen + Associates); county employment figures from Table 5; State employment projection from U. S. Water Resources Council, 1972 OBERS projections, Volume 4.

Sectoral vs. Total Employment. The foregoing methods - average annual numeric change, average annual percent change and proportion of state employment - all use the total employment base to forecast future jobs. Other methods analyze each economic sector to ascertain its past behavior, either in terms of observed change or in relation to the behavior of that sector in a larger area such as the state or nation. A commonly used method which uses this sectoral approach is economic base analysis.

Economic base analysis utilizes the concepts of export activity and local-serving activity introduced earlier in this chapter (see page 250). The economic base of an area is the export activity - also known as basic industry - there, because it is supported by demand from outside the area and therefore is assumed to have been the basis for settlement and continued activity in the area. The economic base generates demand for local-serving, or secondary, activity: both the industries and the workers in those industries spend money for goods and services; part of that money is used to hire people to produce or sell those goods and services; those people also spend money on goods and services and part of that money is used to hire people; and so on. Thus, total future employment may be projected based on two key factors: the level of basic activity and the relationship between basic and local-serving activity.

Figure D-3 illustrates one simple procedure for developing projections using the economic base approach. The first step is to estimate the relationship between basic and local-serving employment, usually by economic sector. This estimate may be developed using the location quotient approach described beginning on page 250. The second step is to forecast the future growth rate for basic employment; this forecast is usually based on historical data, using one of the methods already described, possibly combined with specific knowledge of forthcoming developments. The third step is to apply the relationship between basic and local-serving employment to the forecast of basic employment in order to produce a projection of future total employment. The anticipated increase in local-serving employment may then be allocated among economic sectors. Table D-9 develops a sample employment projection using the economic base method, assuming an average annual growth rate of three percent for export activity employment.

Figure D-3

Economic Base Method of Projection

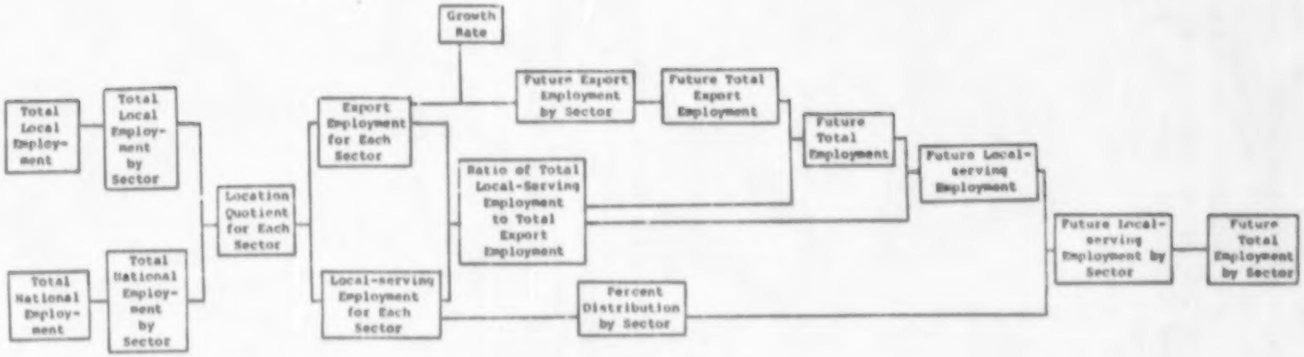

Total Local Employ-ment
Total Local Employ-ment by Sector
Total National Employ-ment
Total National Employ-ment by Sector
Location Quotient for Each Sector
Growth Rate
Export Employment for Each Sector
Local-serving Employment for Each Sector
Future Export Employment by Sector
Future Total Export Employment
Ratio of Total Local-Serving Employment to Total Export Employment
Future Total Employment
Future Local-serving Employment
Percent Distribution by Sector
Future Local-serving Employment by Sector
Future Total Employment by Sector

Table D-9

SAMPLE EMPLOYMENT PROJECTIONS BASED ON ECONOMIC BASE ANALYSIS

Sector	% of Output Exported in 1979[1]	Employment in 1979				Employment in 2002		
		Total	Export	Local-serving	% of Local-Serving Employment	Export[2]	Local-serving	Total
Mining/Forestry	0.0	700	0	700	1	0	2,280	2,280
Construction	8.8	7,300	640	6,660	6	1,260	13,660	14,920
Manufacturing	0.0	18,400	0	18,400	16	0	36,410	36,410
Transportation/Public Utilities	4.9	7,800	380	7,420	6	750	13,660	14,410
Trade	20.3	36,100	7,330	28,770	25	14,470	56,900	71,370
Finance, Insurance, Real Estate	11.1	8,000	890	7,110	6	1,760	13,660	15,420
Services	12.8	28,000	3,580	24,420	21	7,070	47,790	54,860
Government	0.0	21,700	0	21,700	19	0	43,240	43,240
TOTAL		128,100	12,820	115,290	100	25,310	227,590	252,910

Ratio of export employment to local-serving employment in 1979 = 12,820:115,280 = 1:8.99.

Note: Detail does not add to total because of independent rounding.

[1] From Table D-4.

[2] Based on sample annual average growth of three percent.

Sources: Tables D-1 and D-4; Gruen Gruen + Associates

Expected Changes in Economic Characteristics. The projection methods described so far all rely on historical data to predict the future (in this case, future employment) and thus contain the implicit assumption that the conditions which influenced past trends will also influence future trends. As a result, they do not consider the potential for change in the factors that influence economic activity (or, more precisely, they do not consider the potential for change that is different from the change that has occurred during the base period).

The case of Hewlett-Packard is a good example. In a projection prepared 20 years ago and based solely on historical data, the computer industry would not have played a large part. Even if changing conditions were considered, the major factors in Spokane County would most likely have been expected improvements in agricultural yields and the availability of inexpensive power from Grand Coulee Dam. The increasing importance of air transportation, as opposed to rail, may also have been considered.

The continuing evolution of the microcomputer industry, largely a California-centered phenomenon, has only recently begun to affect other areas of the United States. It now appears that the industry has reached a stage in which the development of new products may still be focused in "Silicon Valley" but production of consumer equipment may be located anywhere, because it no longer relies on proximity to the product developers. Therefore, other factors - such as availability and price of land and labor and the amenities of the environment, including affordable housing - may be considered in the selection of sites for new plants. These changing conditions are not reflected in historical data for Spokane County, and thus would not be incorporated in a projection based solely on those data.

Evolution of new industries and of the conditions in those industries are only two factors which may make future conditions different from those of the past. The availability of natural and human resources, changes in technology and in political constraints are other factors to be considered. These types of influences are discussed more fully at the end of this chapter.

Projections of Future Employment in Spokane County

Projections of future employment in Spokane County have been prepared by a number of agencies during the past decade. The methods used and the results obtained are the subject of this section. The various projections are presented in the order of their publication, and are compared in Table D-10 and Figure D-4.

OBERS Projections (1972). The OBERS projections are prepared as a joint effort by the U. S. Department of Commerce, Bureau of Economic Analysis (formerly the Office of Business Economics) and the U. S. Department of Agriculture Economic Research Service. The projections are updated every five years, but there is a lag between the projection date and the publication date. The 1972 projections were published in 1974; the 1977 projections were expected in late 1979 but had not been released as of September 1980. The OBERS projections use the economic base method, relying on income measurements rather than employment as an index of economic activity. The growth rate for income from export activities is derived by using a shift-share analysis, which takes into consideration expected national growth in each industry and observed changes in each industry's share of total employment located in the subject area (in this case, Spokane County).

The projections anticipate an increase in county employment from 105,888 jobs in 1970 to 138,700 jobs in the year 2000, an overall increase of about 22,800 jobs (21.5 percent) at an average annual rate of 0.9 percent. The industrial sectors with the greatest numeric growth are expected to be services, government and trade, while the greatest percentage growth is expected in services, finance-insurance-real estate and government.

Water Resources Study (1976). The Water Resources Study (WRS) for the Spokane Metropolitan Area was prepared in early 1976 by the U. S. Army Corps of Engineers and Kennedy-Tudor Engineers. The employment projections made in that study are based on an examination of the sectoral structure of the Spokane County economy and its relationship to both the national economy and the regional economy, with significant consideration to anticipated changes in technology that could affect sectoral activity. The projections expect a decrease in agricultural employment, no change in mining and forestry, and increases in all other sectors. Manufacturing, transportation-communications-public utilities, finance-insurance-real estate and contract construction are projected to increase their shares of local employment.

Table D-10

EMPLOYMENT PROJECTIONS FOR SPOKANE COUNTY

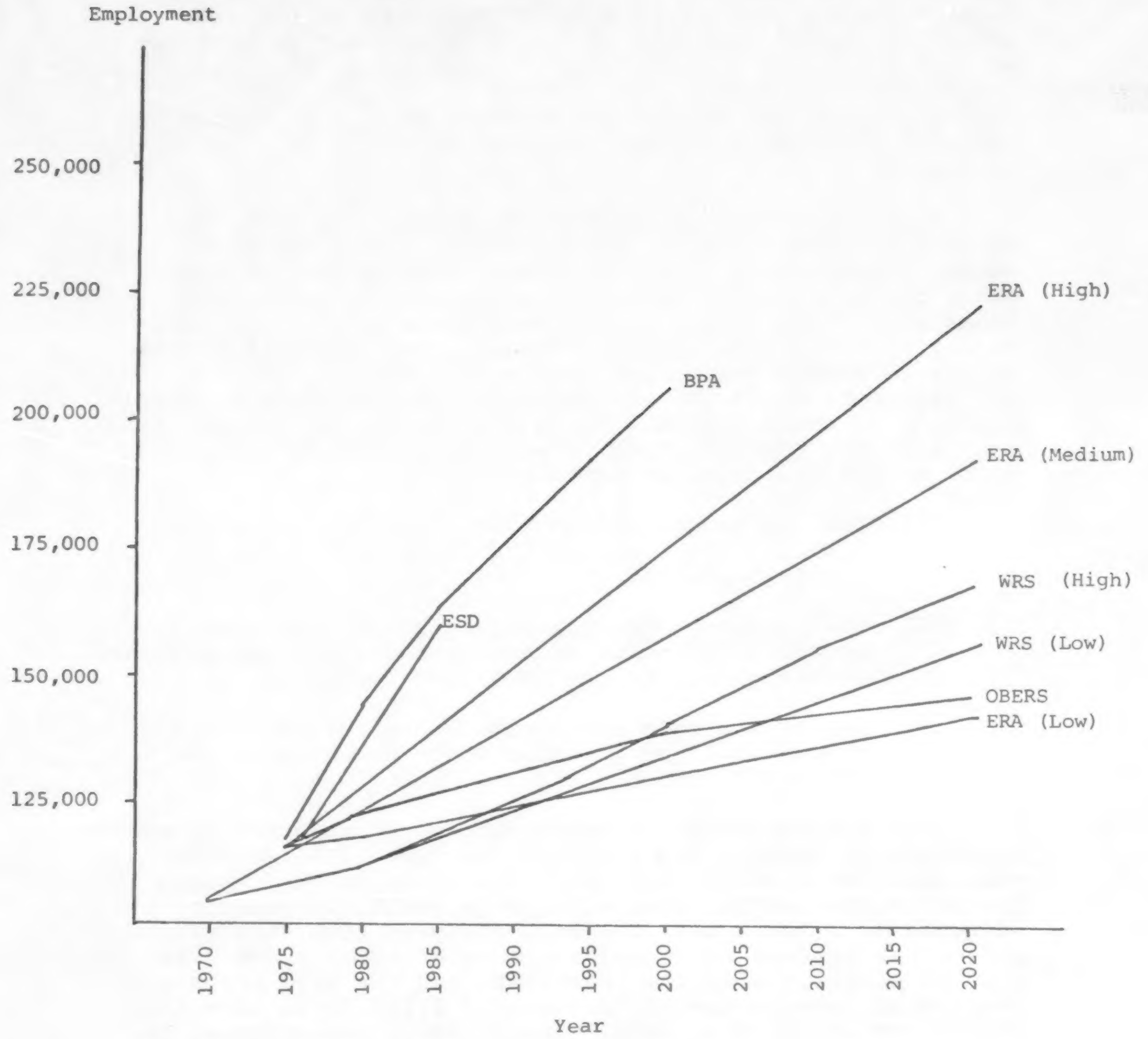
Source (Date)	Employment					Increase 1980-2000	Av. Annual % Increase 1980-2000
	1970	1975	1980	1990	2000		
OBERS (1972)	105,888	-	124,600	130,100	138,700	14,100	0.54
Water Resources Study (1976)							
Low Projection	104,700	-	111,000	121,800	132,900	21,900	0.90
High Projection	104,700	-	118,000	125,000	140,900	28,900	1.15
Economics Research Associates (1976)							
Low Projection	-	115,700	117,400	123,400	129,800	12,400	0.50
Medium Projection	-	115,700	122,700	140,300	158,000	35,300	1.27
High Projection	-	115,700	127,600	151,400	175,000	47,400	1.59
Bonneville Power Administration (1979)	-	117,100	144,100	178,700	206,500	62,445	1.82

Note: Projections which do not extend to the year 2000 or which do not cover the entire county are not included in this table.

Sources: U.S. Water Resources Council, 1972 OBERS Projections, Volume 5; U.S. Army Corps of Engineers, Seattle District and Kennedy-Tudor Consulting Engineers, Metropolitan Spokane Region Water Resources Study, Appendix F; Economics Research Associates, Employment, Population, Income and Other Projections for Spokane County 1975-2000 and Floyd E. Lauerson, A Summary of, and Excerpts from the Report: Employment, Population, Income and Other Projections for Spokane County, 1975-2000; U.S. Department of Energy, Bonneville Power Administration, Population, Employment and Households Projected to 2000, Washington.

Figure D-4

EMPLOYMENT PROJECTIONS FOR SPOKANE COUNTY



BPA: Bonneville Power Administration
ERA: Economics Research Associates
ESD: Washington State Employment Security Department
OBERS: U.S. Department of Commerce, Bureau of Economic Analysis and U.S. Department of Agriculture, Economic Research Service (joint effort)
WRS: Spokane County Water Resources Study

Source: Table D-10

The WRS study includes two projections of employment, which together define a range of likely employment growth. The low projection anticipates an increase from 104,700 Spokane County jobs in 1970 to 132,900 jobs in the year 2000, an overall increase of 28,200 jobs (26.9 percent) at an average annual rate of about 0.8 percent. The high projection anticipates the presence of 140,900 Spokane County jobs by the end of the century, a gain of 36,200 jobs (39.5 percent) at an average annual rate of about 1.0 percent.

Economics Research Associates (1976). In 1976, the Spokane Area Development Council (SADC) asked Economic Research Associates (ERA) to project employment and some other characteristics for Spokane County and several subareas within the county. ERA based their projections primarily on historical trends but noted that economic growth in the 1970-1975 period had been stimulated by EXPO '74 and therefore could not be routinely considered in an extrapolation of those trends. To take this special circumstance into account, ERA developed three sets of projections, based on the following assumptions:

(1) The low projection assumed that future economic growth would occur at the historical rates of the pre-1970 period.

(2) The medium projection also assumed that future growth would occur at historical rates but assigned more emphasis to the 1970-1975 period.

(3) The high projection assumed that future economic growth would occur at or near the rates of the 1970-1975 period.

Expected increases in employment were projected by sector on a numeric basis. The starting year was 1975, with countywide employment at 115,700 jobs. As shown in Table D-10, the low projection anticipates an average annual increase of about 560 jobs to a total of 129,800 in the year 2000; the medium projection assumes an annual increase of about 1,690 jobs, to a total of 158,000 in the year 2000; and the high projection assumes an average annual increase of 2,160 jobs, to a total of 175,000 in the year 2000. In all three projections, the services sector would experience the greatest numeric and percentage increases; trade would be second in numeric increase and finance-insurance-real estate would be second in percentage gain.

Bonneville Power Administration (1979). The Bonneville Power Administration (BPA), in the U. S. Department of Energy, uses an economic base model to forecast future employment. Their model defines the basic industries to include agriculture, mining, manufacturing and federal government, and forecasts employment growth in these industries based on "deliberate choices . . . as to whether additional plant capacity or new plants are built in one county rather than another." The BPA forecast for Spokane County predicts an increase from 117,100 jobs in Spokane County in 1975 to 206,500 jobs in the year 2000, an addition of 89,400 jobs (76.3 percent) at an average annual rate of 2.30 percent. The greatest numeric increases are expected to occur in trade, services and manufacturing, while the greatest percentage increases are expected to occur in finance-insurance-real estate, trade and manufacturing.*

Employment Security Department (1979). The Washington State Employment Security Department (ESD) prepared, in 1979, a projection of employment in Spokane County through 1985. This projection was prepared primarily to forecast the occupational increase in job availability (i.e., professional, sales, clerical, transport workers) rather than the sectoral (i.e., manufacturing, trade, services) increase in employment. The projections "rely primarily on historical staffing patterns and trends", but assume that energy will become relatively more expensive. The projections anticipate an increase in total county employment from 117,200 in 1976 to 159,900 in 1985, an overall increase of 42,700 jobs (36.4 percent) at an average annual rate of 3.5 percent. Services and trade would experience the greatest numeric growth, accounting for over 70 percent of the total.

Projections for the Spokane Metropolitan Area. In addition to the countywide projections described above, two projections have been prepared for the metropolitan Spokane area. This area includes the City of Spokane and the urbanized area extending eastward to Liberty Lake and Newman Lake, northward to encompass the North Spokane suburban area, westward to include the West Plains and southward to include Glenwood-Moran Prairie. The first was prepared by ERA in 1976 and, like the countywide projections prepared at the same time, included low, medium and high alternatives. In the base year of 1975, ERA estimated a total of 106,970 jobs in the study area, which was defined as the Spokane Metropolitan Area Transportation Study area. By the year 2000, the low alternative projected an increase of 13.3 percent, to 121,190 jobs; the medium

*Mining is expected to increase by 100 percent, ranking second in percentage increase, but it accounted for only 0.15 percent of total employment in 1975.

alternative projected an increase of 38.6 percent, to 148,220 jobs; and the high alternative projected an increase of 53.2 percent, to 163,970 jobs. These projections are summarized in Table D-11 and Figure D-5.

The other metropolitan area projection was prepared by the Spokane Regional Planning Conference (SRPC), Transportation Study Division, and is described in two memoranda issued in 1979 (Technical Memorandum FL3 and Technical Memorandum JB11). The projection is based on combined inputs from the ERA forecasts and the preliminary draft Urbanized Area Comprehensive Plan for 26 communities. The SRPC projection anticipates an increase in employment in the Spokane Metropolitan Area from about 105,100 jobs in 1975 to 170,000 jobs in the year 2000, an increase of 64,900 (61.8 percent) at an average annual rate of 1.9 percent. The SRPC projection is preliminary and subject to change.

Projections to 2002. The planning period for the CWMP study is 1982 through 2002. For that reason, it is desirable to extend the projections that have been prepared to 2002 or, for projections that extend through 2020, to interpolate an estimate for that year. These estimates are presented in Table D-12. The ESD projection is not included because it ends in 1985.

Influences on Future Employment

It was noted earlier in this chapter that employment projections are based in large part on historical trends, and for that reason they implicitly (or, sometimes, explicitly) assume that the conditions which shaped those trends will continue to shape employment trends in the future. To the extent that those conditions change - or that the types of changes working in the past are altered in the future - it is likely that the future trends will differ from those of the past, and thus that actual employment change will depart from the projected change. What changes in those conditions might occur in Spokane County?

Technological change was used as an example on page of this chapter. The illustration of Hewlett-Packard, and that company's evolution toward production in geographically dispersed locations, is only one example of this type of change. Other examples might include improved tools or equipment for aluminum production or food processing, decreasing the number of workers needed to achieve a desired level of production; increased use of word processing and computer equipment, which would decrease the number of clerical and technical workers needed; or the development and manufacture of new types of products, which would increase the number of jobs in the affected industry and in the industries which supply the inputs required for manufacture.

Table D-11

EMPLOYMENT PROJECTIONS FOR THE SPOKANE METROPOLITAN AREA

Source (Date)	Employment				Increase 1980-2000	Av. Annual % Increase 1980-2000
	1975	1980	1990	2000		
Economics Research Associates (1976)						
Low Projection	106,970	88,960	114,750	121,190	32,230	1.56
Medium Projection	106,970	113,700	131,200	148,220	34,520	1.33
High Projection	106,970	118,400	141,280	163,970	45,570	1.64
Spokane Regional Planning Conference (1979)[1]	105,098	122,500[2]	-	170,000	47,500	1.65

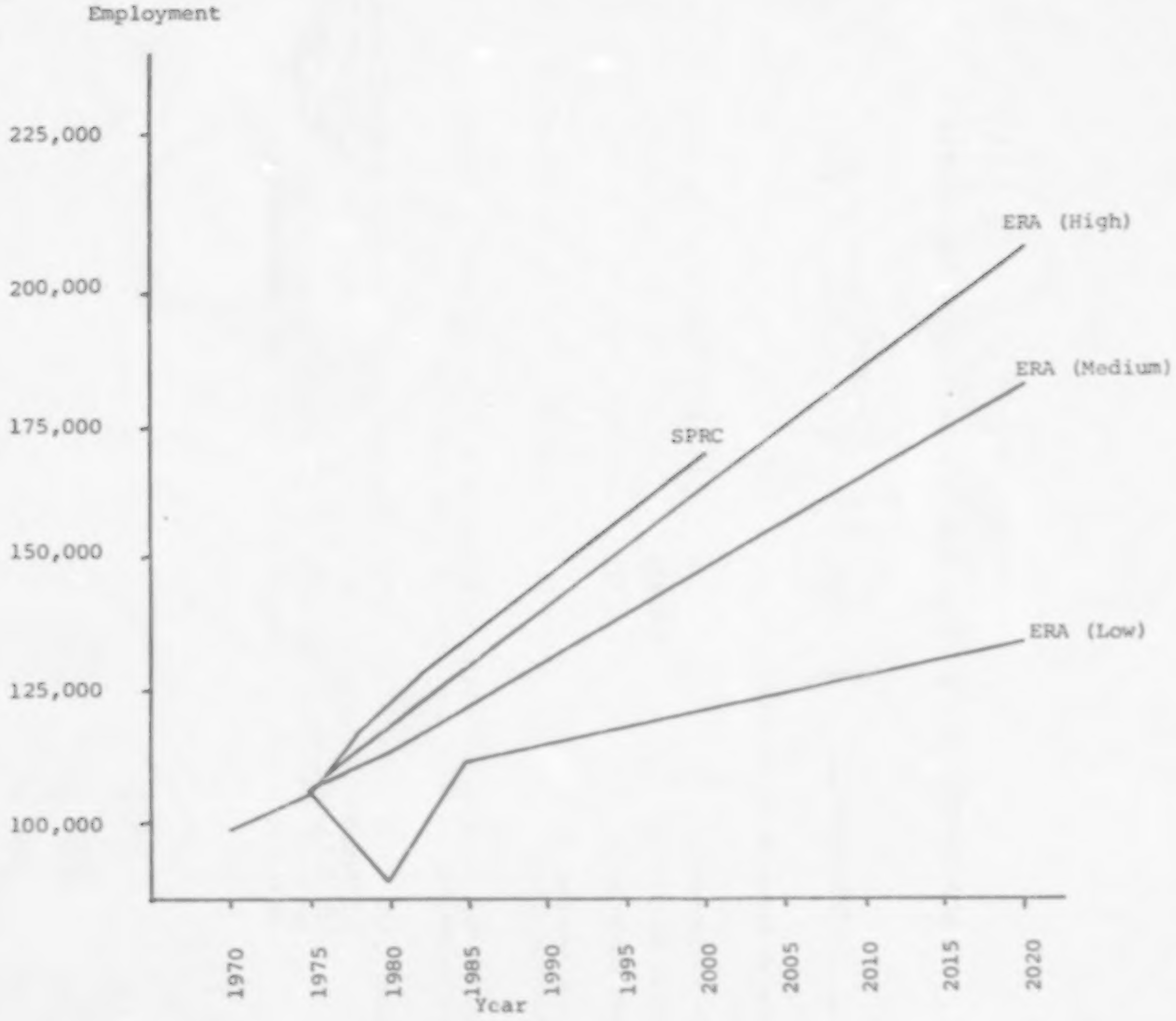
[1] Estimates for other years: 1970 = 98,920; 1978 = 117,000; 1982 = 128,000.

[2] Linear extrapolation from estimates for 1978 and 1982.

Sources: Economics Research Associates, *Employment, Population, Income and Other Projections for Spokane County 1975-2000* and Floyd E. Lauerson, *A Summary of, and Excerpts from the Report: Employment, Population, Income and Other Projections for Spokane County, 1975-2000*; Spokane Regional Planning Conference, Transportation Study Division, Technical Memorandum FL3 (March 21, 1979) and Technical Memorandum JB11 (September 6, 1980).

Figure D-5

EMPLOYMENT PROJECTIONS FOR SPOKANE METROPOLITAN AREA



Source: Table D-11

Table D-12

ESTIMATES OF EMPLOYMENT IN YEAR 2002

Projection	Projected Employment in 2000	Estimated Employment in 2002
Countywide projections		
OBERS	138,700	139,350
Water Resources Study		
Low	132,900	135,120
High	140,900	144,080
Economics Research Associates		
Low	129,800	131,070
Medium	158,000	161,600
High	175,000	179,710
Bonneville Power Administration	206,500	212,060
Metropolitan area projections		
Economics Research Associates		
Low	121,190	122,450
Medium	148,220	151,670
High	163,970	168,548
Spokane Regional Planning Conference	170,000	174,670

Note: All estimates for 2002 derived from linear interpolation or extrapolation.

Source: Tables D-10 and D-11

Another potential influence on future employment growth is the availability of resources needed for production. For example, the availability of inexpensive power was a major factor in drawing the aluminum industry to Spokane County, but the Bonneville Power Administration has notified its customers that after 1981 it will no longer make commitments to supply large, uninterruptible blocks of power to private customers (Walsh, pers. comm., 1980). While this change is unlikely to drive aluminum producers from the area, it is likely to make the county a less attractive site for new aluminum plants and for expansion of existing plants. Other types of resources whose availability could affect economic and employment growth are oil, water (for example, in case of drought) for both agriculture and urban use, and labor. Labor supply would decline if for example, there were a housing shortage which discouraged new workers from moving into the area, if working-age population moved out of the area in great numbers and were not replaced, or if labor force participation by some segment of the working-age population declined; on the other hand, it would increase if the reverse of any of those trends occurred.

OVERVIEW OF HOUSING CONDITIONS

The growth of the CWMP study area will depend in part on the area's ability to supply housing for those who seek to live there. One way to evaluate this ability is to examine past housing characteristics, to see how close the relationship has been between housing and population. This chapter reviews recent and existing housing characteristics in Spokane County and projects the number of dwelling units that will be needed to accommodate future population growth.

Housing Data for Spokane County

The most comprehensive source of housing information for Spokane County is the U. S. Census of 1970. The census provides statistics for the county as a whole, for the City of Spokane and other cities and for the Spokane urbanized area, which includes the city and the portions of Spokane Valley which met the Census Bureau's definition of urban at that time. The urbanized area differs from the CWMP study area in that it omits Liberty Lake and Newman Lake on the east and West Plains and Airway Heights on the west. The Annual Housing Survey of 1974, also published by the Bureau of the Census, updates some of the data for the county. Some general information is available for later years from the Seattle Area Office of the U. S. Department of Housing and Urban Development and from the city and county planning departments. Preliminary counts from the 1980 Census are available for the City of Spokane.

Recent Trends and Existing Conditions

Number of Units and Geographic Distribution

In 1970, the U. S. Census of Housing counted 99,869 dwelling units in Spokane County. Of the total, 99,429 (99.6 percent) were suitable for year-round occupancy and 93,681 (94.2 percent of the latter) were occupied.

The Spokane urbanized area contained 82,915 (83 percent) of the total dwelling units in the county. Of the units in the Spokane urbanized area, 82,888 (98.8 percent) were considered suitable for year-round occupancy and 78,182 (94.3 percent of the year-round units) were occupied.

The City of Spokane had 64,338 housing units in 1970, or 64 percent of the county total. All but 20 of the city's units were suitable for year-round occupancy, and 60,512 (94.1 percent) were occupied. These figures for the county, the urbanized area and the city are summarized in Table D-13.

Table D-13

HOUSING UNITS AND OCCUPANCY IN 1970

	Spokane County	Spokane Urbanized Area	City of Spokane
Total dwelling units	99,869	82,915	64,338
Year-round dwelling units	99,429	82,888	64,318
Occupied dwelling units	93,681	78,182	60,512
Percent of year-round units occupied	94.2	94.3	94.1

Source: U. S. Census of Housing, General Housing Characteristics, Washington, 1970 (Table 8).

By 1974, the number of dwelling units in Spokane County had increased to 112,100, a gain of 12 percent over the 1970 inventory. The number of year-round units had increased to 111,800 (99.7 percent of the total) and the number of occupied units to 103,800 (92.8 percent of the year-round units). These figures are rounded to the nearest 100 units because the Annual Housing Survey, from which they are drawn, is based on a sample of 5,000 units rather than a complete count as used for the census.

In 1980, Spokane County had an estimated 132,137 dwelling units, almost 18 percent more than in 1974 and 32 percent more than in 1970. (Population had increased 15 percent between 1970 and 1980.) Approximately 123,900, or almost 94 percent of the units, were occupied (HUD, 1980).

The City of Spokane had 75,924 dwelling units in 1980 according to preliminary counts from the U. S. Census. (This number is disputed by the city, which estimates a total of 76,112 units. Spokane Daily Chronicle, August 25, 1980.) The census figure would mean that the number of units in the city had increased by 18 percent since 1970 even though city population had declined by almost two percent (from 170,516 in 1970 to 167,393 in 1980). It would also mean that the proportion of all Spokane County dwelling units located in the city had declined from 64 percent in 1970 to 57 percent in 1980.* Thus, Spokane, like many urban areas in the United States, has been experiencing a movement of population from urban to suburban areas. The number of dwelling units in the county and city since 1970 is summarized in Table D-14.

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*The figures for Spokane City and Spokane County are not strictly comparable because of differences in dates (County = March 1980, City = April 1980), sources and (presumably) methodologies. The estimate of 57 percent should therefore be considered approximate.

Table D-14

NUMBER OF HOUSING UNITS IN SPOKANE COUNTY AND CITY, 1970-1980

	Spokane County	Spokane City	City as a % of County
Total Units			
1970	99,869	64,338	64.4
1974	112,100	n.a.	n.a.
1980*	132,137	75,927	57.5
Percent Increase 1970-80	32.3	18.0	-
Occupied Units (Percent Occupancy)			
1970	93,681 (93.8)	60,512 (94.0)	64.6
1974	103,800 (92.6)	n.a.	n.a.
1980*	123,900 (93.7)	70,787 (93.2)	57.1

*Figures for 1980 are not strictly comparable because of differences in date, source and methodology.

Sources: U. S. Census of Housing, General Housing Characteristics, Washington, 1970 (Table 8); City of Spokane, City Plan Commission, personal communication to Gruen Gruen + Associates; U. S. Department of Housing and Urban Development, Seattle Area Office, The Current Housing Market Situation, Spokane SMSA, March 1, 1980.

Trends in Average Household Size

That the number of dwelling units in the City of Spokane increased while the city's population decreased indicates that either the percentage of vacant units increased or that the average number of people per household decreased. Table D-15 presents estimates of average household size for the city and county in 1970 and 1980. The table shows that average population per household declined from 3.1 to 2.7 in the county and from 2.8 to 2.4 in the city (see note to Table D-15 for qualification). The effects of the declines on the demand for housing units are shown in Table D-16, which indicates that 72,100 dwelling units would have been needed to house the City of Spokane's 1970 population at the average 1980 household size

Table D-15

AVERAGE HOUSEHOLD SIZE, SPOKANE COUNTY AND CITY, 1970 AND 1980

	Spokane County	Spokane City
1970		
Total Population	287,487	170,516
Occupied Dwelling Units	93,681	60,512
Population per Occ. Unit	3.1	2.8
1980		
Total Population	331,047	167,393
Occupied Dwelling Units	123,900	70,787
Population per Occ. Unit	2.7	2.4

Note: Average household sizes are slightly overstated because population in group quarters is not eliminated from total population to allow comparability between available data for 1970 and 1980. The 1970 Census reports average household sizes of 2.9 for the county and 2.7 for the city.

Sources: U. S. Census of Housing, General Housing Characteristics, Washington 1970 (Table 8); U. S. Department of Housing and Urban Development, Seattle Area Office, The Current Housing Market Situation, Spokane SMSA, March 1, 1980; Spokane Daily Chronicle, June 15, 1980 and August 25, 1980.

Table D-16

EFFECTS OF DECLINES IN HOUSEHOLD SIZE ON THE DEMAND FOR HOUSING

	Spokane County	Spokane City
1970 Population	287,487	170,516
1970 Household Size	3.1	2.8
Number of Units Needed	93,681	60,512
1980 Household Size	2.7	2.4
Number of Units Needed to House 1970 Population	107,600	72,100
Actual Number of Units	123,900	70,787

Note: Individual figures may not agree because of independent rounding.

Sources: See Table D-15

(70,787 were actually occupied in 1980). It also shows that 107,600 units, or one-quarter of the increase from 1970, were needed to house the county's 1970 population at the average 1980 household size, which means that 16,300 (three-quarters of the increase) were occupied by new population.

Housing Tenure and Type of Structure

Tenure. The term "housing tenure" refers to the ownership status of housing occupants; specifically, whether residents are owners or renters. In 1970, 69 percent of all occupied housing units in Spokane County were owner-occupied and the remaining 31 percent were renter-occupied. Approximately 66 percent of city households were owner-occupants. By 1980, the proportion of owner-occupants in the county had risen slightly to 67 percent; 1980 data on tenure for the city were not available for the city as of November 1980.

Type of Structure. In 1970, 77.6 percent of Spokane County dwelling units were in single-family structures, 20.1 percent were in multiple-family structures and 2.3 percent were in mobile homes. In the Spokane urbanized area, 77.7 percent were in single-family structures, 21.2 percent were in multi-family structures and 1.2 percent were in mobile homes. In the city, a slightly smaller proportion - 75.6 percent - were in single-family structures while 24.0 percent were in multi-family structures and less than one percent were in mobile homes. These figures are presented in Table D-17.

Table D-17

HOUSING UNITS BY TYPE OF STRUCTURE, SPOKANE COUNTY, URBANIZED AREA AND CITY, 1970

Number of Units in Structure	Spokane County		Spokane Urbanized Area		Spokane City	
	Number	Percent	Number	Percent	Number	Percent
1	77,108	77.6	64,375	77.7	48,641	75.6
2+	20,011	20.1	17,554	21.2	15,414	24.0
Mobile Home	2,310	2.3	959	1.2	263	0.4
TOTAL	99,429	100.0	82,888	100.1	64,318	100.0

Source: U. S. Census of Housing, General Housing Characteristics, Washington, 1970 (Table 8).

By 1974, the distribution of units by type of structure was still heavily weighted toward single-family residences, which comprised 76.3 percent of the total. The proportion of single-family attached units, however, had quintupled from 0.6 percent of the total in 1970 to 3.0 percent in 1974. County-wide changes in structure types are summarized in Table D-18.

Table D-18

HOUSING UNITS BY TYPE OF STRUCTURE, SPOKANE COUNTY, 1970 AND 1974

Type of Structure	1970 Number	1970 % of Total	1974 Number	1974 % of Total	Percent Increase	Percent of Total Increase
Single-family, detached	76,500	77.0	81,900	73.3	7.1	43.5
Single-family, attached	600	0.6	3,400	3.0	466.7	22.6
2 to 4 families	7,500	7.5	8,700	7.8	16.0	9.7
5 or more families	12,400	12.5	14,400	12.9	16.1	16.1
Mobile home	2,400	2.4	3,400	3.0	41.7	8.1
TOTAL	99,400	100.0	111,800	100.0	12.5	100.0

Source: U. S. Department of Commerce, Bureau of the Census, Current Housing Reports, Annual Housing Survey: 1974, Housing Characteristics for Selected Metropolitan Areas, Spokane, Washington SMSA (Table 1, page A-01).

Tenure and Structure. Examination of housing tenure and structure patterns together reveals that the households living in owner-occupied single-family residences comprised the majority of county households in both 1970 and 1974, declining slightly (from 64.6 percent to 62.9 percent of all households) during the period. The second largest group was renter-occupants of single-family homes; that group increased slightly, from 13.8 percent to 14.3 percent of all households between 1970 and 1974.

One indicator of the ability of housing suppliers to satisfy housing demand is the change in vacancy rates for different types of tenure structure. Data in the Annual Housing Survey indicate that the homeowner vacancy rate increased from 1.7 percent to 1.9 percent between 1970 and 1974, while the rental vacancy rate increased from 7.1 percent to 9.0 percent. These apparent increases indicate that suppliers were more than able to meet demand during the period. (It should be noted that although 1974 was a recession year for the country as a whole, it was the year of EXPO in Spokane and the recession did not affect the county's economy until the next year.) Data for 1980, compiled by the Seattle Area Office of HUD, indicate that the homeowner vacancy rate has declined once more to 1.7 percent while the renter vacancy rate has remained at 9.0 percent.

The Annual Housing Survey affords a more detailed look at changes in tenure, structure and vacancy rates. As indicated in Table D-19, which summarizes those data, the number of vacancies for each type of structure increased between 1970 and 1974, as the overall vacancy rate increased from 5.7 percent to 7.2 percent.

Table D-19

CHANGES IN TENURE, TYPE OF STRUCTURE AND VACANCIES, SPOKANE COUNTY, 1970-1974

	Type of Tenure					
Type of Structure	Own	Rent	Total Occupied	Vacant	Total Units	Change in No. of Units as Percent of Change in Occupied Units
1 family, detached	4,400	700	5,100	300	5,400	105.9
1 family, attached	400	2,200	2,600	200	2,800	107.7
2-4 family	0	600	600	600	1,200	200.0
5+ family	- 100	1,000	900	1,100	2,000	222.2
Mobile home	700	200	900	100	1,000	111.1
TOTAL	5,400	4,700	10,100	2,300	12,400	122.8

Source: U. S. Department of Commerce, Bureau of the Census, Current Housing Reports, Annual Housing Survey: 1974, Housing Characteristics for Selected Metropolitan Areas, Spokane, Washington SMSA (Table 1, page A-01).

Future Housing Conditions

Influences on Future Housing Conditions

The number and types of dwelling units in Spokane County and, more specifically, in the general sewer service area in the future will depend on a series of key factors. The number of people living in the area, the number of households - and, thus, the average number of people in each household - and the incomes of those households in relation to housing prices will define the number of housing units demanded. The preferred living arrangements of the households, influenced by their incomes, will influence the types of units demanded. The costs of land, building materials, labor and financing will influence the ability of private developers to supply the housing demanded. The availability and acceptance of federal, state and local programs for housing provision will influence the ability of non-market suppliers to satisfy the housing needs of households who cannot afford to compete for market-priced housing.

Housing Projection

By making explicit assumptions about the factors identified in the preceding paragraph, it is possible to develop a projection of the number and types of housing units that will be located in the CWMP Study Area - as approximated by the general sewer service area - in future years. Factors which can be quantified based on available information are used to derive a housing projection. Other factors are described qualitatively at the end of this chapter.

Number of People Living in the Area. Jones and Stokes Associates estimate that the 1980 population of the general sewer service area, excluding the City of Spokane, numbered 120,065 residents. They project that this population will increase to 172,907 by the year 1992 and to 214,216 by the year 2002. This increase would mean the addition of 94,151 residents to the general sewer service area during the 22-year period.

Number of Households. Table D-15 indicates that the average household size in Spokane County in 1980 was estimated at 2.8 persons and the average household size in the City of Spokane was estimated at 2.4 persons. The Spokane Regional Planning Conference (SPRC) projects that average household sizes in its transportation study area (roughly equivalent to the general sewer service area) will decline from 2.8 in 1978 to 2.7 in the year 2000. Because the SPRC area is similar to the general sewer service area and includes both city and county territory, those estimates are used in this study. The figures provided by SPRC are used to derive estimates of 2.8 persons per household in 1980 and 2.7 per household in 2002. Based on these averages, the number of households in the general sewer service area is expected to increase from 105,500 in 1980 to 152,100 in 2002, an overall gain of 46,600 households.

Number of Housing Units Demanded. To translate the number of households into an estimate of housing units, the former figure must be adjusted by a vacancy factor. The overall vacancy rate for Spokane County, the Spokane urbanized area and the City of Spokane in 1970 was about six percent. Assuming that this rate applies to the general sewer service area and continues into the future, then there were approximately 45,452 housing units in the area in 1980. This number may be expected to increase to 84,099 in the year 2002. The derivation of this projection, with an interim estimate for 1992, is presented in Table D-20.

Table D-20

HOUSING UNITS IN THE GENERAL SEWER SERVICE AREA, 1980 (ESTIMATE), 1992 and 2002 (PROJECTIONS)

	1980	1992	2002	Increase 1980-2002
Population	120,065[3]	172,907	214,216	94,151
Average Household Size	2.8	2.8	2.7	-
Number of Households[1]	42,880	61,752	79,339	36,459
Vacant Housing Units[2]	2,572	3,705	4,760	2,188
Total Housing Units	45,452	65,457	84,099	38,647

[1] Same as number of occupied dwelling units

[2] Six percent of total housing units

[3] 1980 preliminary census for Spokane County less the preliminary census for the City of Spokane and less estimated 1980 population of areas outside of GSSA

SOURCES: Jones & Stokes Associates, Inc. and Gruen Gruen + Associates.

Types of Housing Units Demanded. Table D-18 indicates a shift in housing construction in Spokane County away from detached single-family units in favor of attached single-family units and units in multi-family structures. No breakdown is provided, however, for types of units built in the unincorporated urbanized area, where the majority of new units in the general sewer service area will be built. In the absence of such specific data, it may be assumed that the trend toward attached single-family and smaller-structure (two- to four-unit) multi-family dwellings will continue. Reasons for this trend include both price considerations and the reduced amount of time that dual-worker households have available for yard maintenance.

Other Factors. A number of other factors, some of which are mentioned above, will affect the number of new housing units built in the general sewer service area between 1980 and 2002. The relationship between household incomes and housing prices may affect not only the types of units demanded but also the ability of a household to pay market rates for any type of housing. Historically, housing economists have expected households to spend 25 percent of their incomes to mortgage or rental payments; that ratio has climbed to 30 percent and higher in recent years.

A second factor mentioned above is the availability and implementation of public housing assistance programs. If households cannot afford market-priced housing, they must either seek government assistance in the form of payment subsidies or price subsidies, or they must seek housing elsewhere.

A third factor is political and governmental influence on housing production. This influence may take the form of explicit or implicit growth management programs; such programs could increase or decrease the costs and/or attractiveness of building various types of housing.

Summary. The number of housing units in the CWMP Study Area, as approximated by the general sewer service area, is projected to increase from an estimated 45,452 in 1980 to 65,457 in 1992 and 84,099 in 2002. The accuracy of this projection will depend on the actual amount of population growth, actual average household sizes and vacancy rates, and a number of financial, political and governmental influences.

OVERVIEW OF FISCAL CONDITIONS

The ability of Spokane County and the other public agencies included in the CWMP study area to accommodate future growth will depend in part on their ability to provide services to new population, businesses and industries. The ability to provide services, in turn, depends on two factors: the availability of any natural resources needed (such as water) and the ability to pay the costs of service delivery. These costs include expenditures for capital facilities, such as reservoirs and water pumps, firefighting equipment, police stations, libraries, parks and wastewater treatment facilities, and expenditures for personnel such as engineers, administrators, firefighters, police and recreation leaders.

One indicator of future ability to provide public services is the fiscal, or financial, condition of a public agency. This chapter outlines the general framework of local government finance in Washington and then describes the services provided by each public agency in the study area and reviews its fiscal condition.

Framework for Local Government Finance

Types of Local Governments

There are two types of local government entities in the CWMP study area: general purpose governments and special districts. The distinguishing characteristic of general purpose governments is that they are responsible for the overall government of the area; for example, by a mayor and council (cities) or by a board of commissioners (county). These entities generally also provide other services, such as public protection (police or sheriff, firefighting), libraries, parks and recreation, water and sewers, either directly or via arrangements with other agencies. The general purpose governments in the study area are the County of Spokane, the City of Spokane, the Town of Millwood and the City of Airway Heights.

Special districts are organized for the express purpose of providing a particular type of service, such as schools, fire protection, libraries, water or sewers. They have no responsibility for general government. Special districts within the CWMP study area include fire districts, school districts, cemetary districts and the Liberty Lake Sewer District.

Local Government Costs and Revenues

As noted above, local governments incur costs for service provision in two ways. First, there are the costs of building or acquiring the capital facilities and equipment needed to provide services. Second, there are the costs of actually "delivering" the services: police patrols, librarians, recreation leaders, plant operators, city administrators, planners, engineers, street repair people and other workers as well as facilities operations and operating supplies.

How does an agency pay these costs? There are three primary sources of money for capital expenditures: (1) the issuance of bonds (discussed further below), (2) grants or loans from federal and state governments and (3) accumulated reserves. When bonds are issued or loans from other agencies are accepted, however, the debt service on (money needed for repayment of) those funds becomes an ongoing cost just like salaries and other operating costs. These ongoing costs for debt service and operations are covered with revenues from four primary sources: (1) property and other taxes, (2) service/user charges, (3) shared revenues from state and federal governments and (4) development fees.

The sources of revenue named above are themselves subject to rules about maximum collections, methods of distribution and ultimate use. State shared revenues from gasoline taxes, for example, are assigned for road construction and maintenance, while some revenues from sales tax redistributions are allocated for stadium and other public meeting facility improvements; some federal monies are designated for particular uses or neighborhoods while others may be used for virtually any type of expense; property taxes and bond revenues are limited not in use (although bonds must be used for capital expenses) but rather in the amount of money that may be raised. These two sources, which are of major importance to local governments, are discussed in further detail in the following paragraphs.

Property Tax. Property taxes are ad valorum taxes levied on real property. The amount of tax on a particular property is calculated by applying the tax rate, expressed in dollars per $1,000 assessed valuation, to the assessed value (equal to full market value) of the property. The total tax levied by all government entities may not exceed one percent of the assessed value unless voters have approved general obligation bonds or special one-time levies; in those cases, the amount needed to repay the bonds may exceed the one percent limit.

The amount of property tax collected is subject to a further limitation: that the total property tax revenue collected by a local government in a given year may not exceed 106 percent of the largest amount collected in any of the preceding three years. This "limit law", as it is called, is designed to smooth out the effects of reassessments. The limit law is subject to three exceptions: (1) the tax override provision described in the preceding paragraph, (2) the addition of new development to the tax base and (3) a one-time, one year suspension of the limit that may be voted by the electorate.

Bonds. Three types of bonds may be issued by local governments in the State of Washington. General obligation bonds are issued against the security of assessed valuation of property within the agency's jurisdiction and are repaid out of property tax revenues. Bonds not exceeding the value of 0.75 percent of the assessed valuation may be issued by the governing body (city council, county commissioners) without a vote of the people; these bonds must be repaid out of ordinary revenues, with no increase in property taxes above the one percent or 106 percent limits. Bonds not exceeding the value of 7.5 percent of assessed valuation (including those described above) may be issued with approval from the electorate, and tax surcharges may be levied to repay them. The 7.5 percent allowance is divided equally among general purposes, utility purposes, and open space and park facilities.

Revenue bonds may be issued against the security of operating revenues from a facility or service. The value of bonds issued is limited to approximately 70 percent of the debt coverage available. This type of bond is generally issued by enterprise services such as water or sewer utilities.

The third type of bonding instrument available is a local improvement district (LID) or utility local improvement district (ULID) bond. These bonds are issued to cover the cost of specific capital improvements in specifically-defined geographic areas, and are issued against the assessed value of property in those areas. Although local governments generally assume responsibility for selling and repaying these bonds, they have no direct financial involvement.

Fiscal Conditions of Local Governments in the CWMP Study Area

County of Spokane

Services Provided. The County of Spokane is a general purpose government. It provides some services to all residents of Spokane County and its cities, including the assessor, social services, public health, cooperative extension, interstate fair, county jail, various courts and other justice services, and elections. It also provides general government, sheriff protection and some other services (primarily road-related) to residents of the unincorporated area of the county.

Total Budget and Current Expense Fund. The Spokane County budget for 1980 totals $48,381,070 (excluding amounts that appear twice for accounting reasons), of which $25,452,581 (53 percent) comprises the current expense fund. Services paid for with the current expense fund include the County Sheriff (25 percent of fund expenditures); other law and justice services, including superior court, district court, juvenile court, prosecuting attorney, public defender and corrections (25 percent); and countywide administrative services such as assessor, treasurer, clerk and auditor (15 percent). The primary expenditure category for the current expense fund is personnel (wages and salaries), which accounts for 65 percent of fund expenditures.

The main sources of revenue for the current expense fund are property tax (31 percent), revenue from other governments (17 percent) and retail sales/use tax (15 percent). Property tax levies differ between incorporated and unincorporated areas in recognition of the fact that some services are used by all county residents and others are used primarily by residents of unincorporated areas. Maximum allowable county levies per $1,000 of assessed valuation are $1.80 countywide and an additional $2.25 in unincorporated areas, but the aforementioned 106 percent limit sometimes precludes levies of the full allowable amount.

The major sources of revenue from other governments are liquor excise taxes and profits, federal revenue sharing, motor vehicle fuel taxes, payment for joint use agreements with the City of Spokane and criminal justice grants from the federal and state governments. Sales taxes derive from the 0.5 percent levy in unincorporated areas and 15 percent of the local share from cities in Spokane County.

Outstanding Bonds. As of December 1979, Spokane County had outstanding general obligation indebtedness of $16,277,993. This debt comprised 15.5 percent of the allowable general obligation indebtedness. About half of this debt was voted by the county electorate in two bond issues - one for the juvenile court and one for the public safety building - while the rest was incurred on the authority of the County Commissioners.

Outlook. The County of Spokane has historically adopted a conservative approach to financial management. This approach includes a reliance on local rather than federal sources of revenue, severe limitations on expenditures and careful management of county investments. The 1980 budgeting process extended the zero-base budgeting approach that had been tried for several years to 17 additional departments; whether for this reason or other reasons, both the current expense fund and the total budget for 1980 were smaller than that for 1979. The county budget director foresees no fiscal problems related to future county population growth.

City of Spokane

Services Provided. The City of Spokane is a general government which provides a complete range of services to its residents. These services include general government administration, planning, police and fire protection, municipal courts, libraries, parks and recreation, street and traffic engineering, water, wastewater collection and treatment and refuse collection and disposal. The city also provides public transportation in the form of a bus system, but a public transit district has recently been formed and is expected to assume operation of the system within the next six months (Cole, pers. comm).

Total Budget. The City of Spokane budget for 1980 totals $61,824,909 (excluding interfund transfers). The major expenditures are for security of persons and property, which includes police, fire and protective inspection (34 percent); transportation, which includes streets, arterial streets, traffic engineering, street lighting and related services (21 percent); physical environment, which includes parks and recreation, community development, engineering and related activities (15 percent); and general government (12 percent). By type of cost, personnel (wages, salaries and benefits) absorbs most of the budget (54 percent), followed by supplies and services (15 percent) and arterial streets (9 percent). The major sources of revenue are shared revenue from federal and state governments (29 percent and 11 percent, respectively), utility taxes (12 percent), property taxes (11 percent) and retail sales/use taxes (10 percent).

Current Expense Fund. The city's current expense fund for 1980 balances at $39,955,528, or $33,780,794 when interfund transfers are excluded. The latter amount represents 55 percent of the total budget. The largest departmental outlays are budgeted for police (27 percent of fund expenditures), fire protection (22 percent) and public works engineers (5 percent). Other services covered by this fund are city administration, planning, municipal court and public buildings. The fund allocates a total of $5,688,344 to the city street fund, the library fund and the park fund.

Primary sources of revenue for the current expense fund are business taxes (21 percent), property taxes (19 percent), retail sales/use taxes (17 percent) and state shared revenues and grants (11 percent). The property tax levy for 1980 is $3.07; a maximum of $3.60 is allowed by law but the 106 percent limit restricts the city's ability to charge the full amount.

Outstanding Debt. In July 1980, Spokane issued $10,000,000 in general obligation bonds, of which $9,000,000 was for improvements to the new city hall and $1,000,000 was for improvements to the city's stadium, opera house and convention center. These issues brought the city's total general obligation debt to $18,635,517, or 11 percent of general purpose debt capacity. Of the total outstanding debt, however, $16,989,312 (91 percent), including the latest bonds, was non-voted, issued under the authority of the City Council; thus, nearly 91 percent of the non-voted debt capacity was utilized. The debt capacity limit will increase when property is reassessed for 1981.

One reason for the liberal use of non-voted debt is that City of Spokane voters have historically been reluctant to approve bond issues. Voted general obligation bonds were approved in 1962 and 1968; in addition, voters approved a one-time tax override to complete Riverfront Park in the mid-1970's and a one-time levy to replace the city's fire equipment in 1978.

The city has no outstanding revenue bonds or park and open space bonds. Thus, the $61,661,626 of debt capacity for each of those areas is fully uncommitted.

Outlook. Historically, the City of Spokane's fiscal condition has been characterized by several factors: (1) relatively constant population, which minimizes the need for service increases based on population; (2) average yearly property tax revenue of eight to nine percent, resulting from the addition of new construction to the assessment base; (3)

average yearly sales tax revenue increases of 15 percent before the tax was removed from food and medicine, with the increase this year estimated at about nine percent; and (4) heavy reliance on state and federal monies for capital expenses. Careful budgeting and management have allowed the city to maintain or slightly expand its number of employees. The additions to property tax and sales tax revenues have in the past enabled the city to meet increasing personnel costs; however, the finance manager is pessimistic about 1981 because firefighters have won a 19.5 percent salary increase and police a 15 percent increase for that year. Preliminary budget estimates show a deficit of $6,637,000 in the current expense fund which must be eliminated before the budget is adopted (Cole, pers. comm.).

The city's finance manager also foresees increases in the need for user charges for utilities and for revenue bond issues in the near future to cover rising costs and needed improvements. While the sewer system is "temporarily" in good shape, increases in user fees are needed to cover the rising costs of labor, chemicals and inflation of other operating costs at the new plant. A bond issue will be needed to fund the city's share of a project to separate the sanitary and storm sewer systems, which has been mandated by the U. S. Environmental Protection Agency.

Other bond issues may also be needed, depending on actions taken by the city. Either of two water-related projects would require bonds: the extension of water supply to the West Plains area, which may or may not be annexed to the city, and an expansion of the city's hydroelectric power plant. A third bond issue could be needed if the city decides to build a waste-burning facility, designed to be power-producing, that is or will soon be under study. More immediately, a bond may be proposed to replace the existing refuse collection trucks. An increase in the refuse collection fee is also under study (Cole, pers. comm.).

Annexation of currently-unincorporated areas represents the primary opportunity for growth in the City of Spokane. The city sees annexations as good for the community as a whole even though it sees the private sector as the main beneficiary of such actions. The city's finance manager notes that the city must make significant initial capital expenditures - i.e., for water, sewer and transit services - and then wait for development that will produce public revenues (Cole, pers. comm.). The city is currently engaged in a study of the fiscal implications of alternative annexation plans.

Town of Millwood

Services Provided. The Town of Millwood is a general purpose government which provides general government, fire protection (via a volunteer fire department), library, parks and some wastewater treatment service. Police protection is provided by the County sheriff, and water is supplied by a private company.

Total Budget and Current Expense Fund. The Town of Millwood budget for 1980 totals $406,141. Of the total, $183,916 (45 percent) is included in the current expense fund. The primary expenditures from that fund are for financial and administrative expenses (23 percent) and general facilities (24 percent); the latter category includes improvements to buildings, machinery and equipment and other maintenance and supply costs.

Major sources of revenue for the current expense fund are state shared revenue (22 percent), retail sales/use taxes (11 percent) and property taxes (9 percent). The town's property tax levy in 1980 is $1.835 per $1,000 assessed valuation.

Outstanding Debt. The Town of Millwood has no outstanding bonded indebtedness. The town's practice is to pay for capital improvements out of accumulated cash reserves.

Outlook. The Town of Millwood appears to be in sound fiscal condition, with no outstanding debt, a cash reserve of $86,000 (21 percent of the total budget) at the beginning of 1980. The town anticipates little if any growth - population has actually declined slightly in recent years as grown children have moved out of their family homes - and no change in service provision.

City of Airway Heights

Services Provided. The City of Airway Heights is a general purpose government which provides general government, police and fire protection, library, parks and water services.

Total Budget and Current Expense Fund. The City of Airway Heights adopted budget for 1980 totals $491,745. When interfund transfers are excluded, the budget totals $420,000. Of the latter amount, $113,980 (27 percent) is allocated to the general expense fund, which covers general government, police, fire protection and health services. Primary sources of revenue for the current expense fund are retail sales/use taxes (25 percent), state shared revenue (19 percent) and property taxes (15 percent). The property tax levy for 1980 is $4.475 per $1,000 assessed valuation.

Outstanding Debt. Airway Heights has two outstanding bond issues: the 1959 water bond and the 1972 water bond. The total amount of indebtedness does not appear in the city's budget, but debt service on these two issues totals $16,920 in 1980 (four percent of the total budget). The city's debt limit, on the 1980 assessed valuation, is $54,370 for non-voted general obligation debt (those issued under council authority) and $543,700 for all general obligation debt (voted and non-voted).

Outlook. Based on budget indicators - which include a cash reserve equal to nearly eight percent of the total budget and a property tax levy smaller than the statutory limit - Airway Heights appears to be in a sound fiscal position. In addition to these indicators, it may be noted that the city already has a framework for providing the public services required for a larger community, as it already provides its own police, fire protection, library and park. Nevertheless, the Spokane County Boundary Commission recently denied a request by Airway Heights to annex an adjacent area that would approximately double the town's size, citing in part a concern for the city's fiscal ability to handle growth in that large an area.

Liberty Lake Sewer District

Services Provided. The Liberty Lake Sewer District is the only special purpose sewer district within the CWMP boundary. The district provides wastewater collection and treatment service to about 760 customers in an approximate 2,500-acre area surrounding Liberty Lake. In May 1978, the district also became a water district, and in August 1980 acquired the authority to enter into binding arbitration in order to purchase the private system that supplies water to about 500 users in the area.

Operating Finances. The district charges connection fees to new customers and monthly user fees to customers already connected to the system. Operating income in the first half of 1980 was $68,020 and income from other sources, such as investments plus a property tax levy to cover payments on outstanding general obligation bonds, was $18,790, for a total six-month income of $86,810. Operating expenses include the cost of operating the existing treatment plant, administrative and general expenses, depreciation of the plant, interest on outstanding debt and taxes; they totaled $82,400 in the first half of 1980, leaving the district with net income of $4,410 in that period. It may be noted that the inclusion of depreciation expense in the operating expense category constitutes a conservative fiscal approach, because the $24,160 allocated to depreciation represents a reserve for future improvements to or replacement of existing facilities rather than out-of-pocket expenditures.

Capital Program. The Liberty Lake Sewer District is currently engaged in the process of constructing a new wastewater treatment plant. The plant will be a mechanical, activated sludge operation, with a design capacity of one million gallons per day (1 mgd). The district will have rights to use 475,000 gallons per day (gpd) capacity, while three private parties - Hewlett-Packard, the Highlands and Homestead - will have rights to the remaining 525,400 gpd. The three private parties will pay for their share of the plant capacity; the district is funding its share through grants from the U. S. Environmental Protection Agency, the U. S. Farmer's Home Administration and the Washington State Department of Ecology, which combine to 90 percent of the cost, plus issuance of $1,119,300 in revenue bonds, $300,000 in general obligation bonds, $100,000 in local improvement district (ULID) bonds issued on behalf of landowners at the north end of the district and connection fees ($400 for existing homes, $1,300 for new development). The cost of the new plant will be $4,877,880, based on the accepted construction bid, and is scheduled to be ready for operation by early 1981.

Future capital improvements are expected to include additions to the new treatment plant and improvements to the recently-purchased water system. Factors encouraging future expansion of the treatment plant are a requirement that 20 percent of design capacity be kept in reserve, a projection that Hewlett-Packard will itself demand 415,000 gpd of capacity by the beginning of 1996 and the desire to maintain water quality in Liberty Lake and of the area's drinking water supply by minimizing septic system use in the watershed. Planning for plant additions will begin as soon as construction of the current project is underway. The plant design is such that capacity increments of 500,000 gpd are feasible. The district is committed to including phosphorus removal capability in any future improvements. Expansion of the plant to a design capacity exceeding 3 mgd would require relocation of the plant's outfall, but district staff do not foresee that much expansion at this time (Kaun, pers. comm.).

Anticipated improvements to the water system will improve water pressure for fire protection on the west side of the lake and increase the water supply on the north side. The district plans to issue ULID bonds totaling $1,500,000 to finance this work.

Outlook. According to the district's manager, the Liberty Lake Sewer District has planned carefully for fiscal solvency. They have adopted policies and resolutions which obligate developers of projects other than owner-occupied single-family residents to make financial contributions for plant capacity, interceptors and planning. In this manner, the district has attempted to insure that new development will pay for both capital and operating expenses incurred by the district to serve it (Kaun, pers. comm.).

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Appendix E

COORDINATION

STATE OF WASHINGTON

Dixy Lee Ray
Governor

OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 West Twenty First Avenue, M.S. KL 11, Olympia, Washington 98504 206/753-4011

NOV 17 1980

November 14, 1980

Mr. Allen C. Fitz
Collins, Ryder & Watkins
3815 - 100th Street S.W.
Tacoma, WA 98499

In reply refer to: 165-F-EPA-07

Re: Spokane 201 Wastewater Facilities Plan/Comprehensive Wastewater Management Plan

Dear Mr. Fitz:

A staff review has been completed of the proposed Spokane 201 Regional Treatment Facilities Plan. Since the information provided did not indicate which facilities already are in place and which are proposed, with some exceptions, it is difficult to make site-specific comments and recommendations. All of the planning units reflect the full range of potential for the existence of cultural resources, that potential depending on varying combinations of past and present microenvironmental factors. The study area also contains a number of known historic and prehistoric sites and structures and occurrences of human burials.

Our comments regarding specifically identified project sites are as follows. None of the sites contains known cultural resources, however, this may be more a reflection of the lack of survey than of the existence of resources.

> Indian Trails Storage/Equalization Basin Site: moderate potential for the potential for the occurrence of archaeological resources.
>
> Spokane Valley (Felts Field) Treatment Plant Site: high potential for the existence of archaeological sites.
>
> North Spokane Treatment and Disposal Site and Treatment and Disposal Site for North Spokane, Spokane Valley, Moran Prairie, Liberty Lake, and Newman Lake: moderate to high potential for the occurrence of archaeological sites.

North Spokane (Confluence) Treatment Plant Site: high potential for archaeological sites.

Downriver Land Application Site: moderate potential for archaeological sites.

We recommend that those areas having high potential for the occurrence of archaeological resources be subjected to intensive archaeological survey. Such a survey would include a literature and records search, informant interviews, and intensive field studies by appropriate professionals. Areas exhibiting moderate potential should be included in the literature and informant studies; the need for subsequent studies and their intensity would be determined on the basis of the results of preliminary research. It should be noted that any new land disturbance, such as for interceptors, pump stations, and other facilities, also should receive the same consideration. When specific project alternatives and locations of proposed facilities have been determined, we will be pleased to assist you in identifying known resources and recommending areas needing further consideration.

Sincerely,

JEANNE M. WELCH, Deputy State
Historic Preservation Officer

Sheila A. Stump, Archaeologist

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